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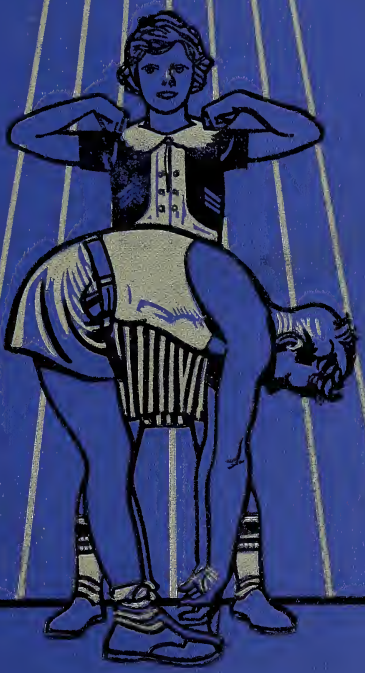

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"

MIDDLE-AND-UPPER-GRADE SERIES

Growing Big and Strong

Safety Every Day

Doing Your Best for Health

Building Good Health

Helping the Body in Its Work

The Healthy Home and Community

"

BUILDING GOOD HEALTH

BY

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122604

This is the story of the first feeding experiment recorded in history. The experiment proved that food makes a difference in the way people look. Many hundreds of years went by before scientists learned why food makes a difference in looks and in health and strength. We know a great deal more about foods today than was known twenty-five hundred years ago when Daniel and his friends lived in Babylon. We know that food may make the difference between growing and not growing. It may make the difference between a strong body full of energy for play and work and a weak body that gets tired very easily. It may make the difference between illness and health. In this book you may learn why food makes a difference in looks, strength, and health, and how you may help your body to use food in growing strong, sound, and straight.

BUILDING
GOOD HEALTH

UNIT I

How Boys and Girls Grow Up

Peter lived in the city, but he had an uncle who had a farm in the country. During spring vacation Peter was invited to spend a week on his uncle's farm. The green buds were beginning to open out on the apple trees. In the fields men were plowing the brown earth, damp with melted snow, and sowing wheat and oat seeds. A mother hen with a family of yellow chicks scratched busily for worms and bugs in the barnyard. Two robins were building a nest in an apple tree. In the meadow where the grass was turning green, a calf, tagging after a big brown cow, kicked up its heels and ran when Peter leaned over the fence to watch it. Peter never crossed the meadow alone. He was afraid of the cow.

In the late summer, a week or so before school opened, Peter went back to the farm. The apple trees were now hung with shining red apples. In the fields where the seed had been sown, brown stubble stood as a reminder of the golden grain that had long since been harvested. The yellow chicks had become young roosters just learning to crow and little brown hens scratching busily for themselves. The wobbly-legged calf was now almost as big as her mother. The nest in the apple tree was empty, and smart young robins were exercising their wings for their first trip south, away from the home nest where they had been born and brought up and taught to fly.

Even the sounds of the night were different. Instead of the spring song of the peepers, bullfrogs croaked in the

marsh and crickets chirped in the dry grass. The only things that had not changed were the stone fences and the white rutted road winding up and over the hill and the red barn and the gray farmhouse among the cedar trees.

"You've changed some," said the hired man to Peter, as they went one evening to milk the cow.

"What makes you think so?" asked Peter.

"Why, you're taller than you were in the spring," said the hired man. "You do things better, too. You can jump the fence into the cow pasture now. Last spring you crawled between the bars."

DO YOU KNOW

What had caused the changes on the farm when Peter returned to it in the fall?

What had caused the changes in Peter?

Why an acorn grows into an oak tree?

What is meant by growth?

How growing things grow?

What a living body needs to make it grow?

One of the principal differences between a jellyfish and a baby?

How we know we are growing?

Steven A. Coons

Both Peter and the calf had grown during the summer

WHAT IS GROWTH?

What does a little child do when he begins to build a tower of blocks? He starts with one block and adds other blocks to it until the tower is complete. In building a stone wall a man starts with one stone. We cannot think of building without thinking also of one thing added to another thing—brick laid on brick, one board nailed above another board, one piece of steel fastened to another piece of steel.

Growing is a form of building. It is different from the building of a stone wall or a house or a skyscraper only in the materials used. We may, for example, use oak boards to build the framework of a house; but the living oak tree

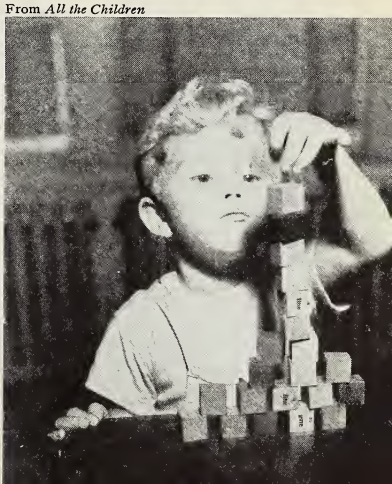
from which the boards came grew from an acorn. The principal difference between the oak wood used in building a house and the acorn from which an oak tree grows is that one is without life and the other is alive. Growing is building something alive out of living material. Living things grow because the material out of which they are built can multiply itself. If we placed an oak board on the ground and left it there for ten or fifteen years, we should not expect to find a whole pile of oak boards when we finally came back. But if we plant one acorn in the ground we can expect some day to have a whole tree bearing acorns.

What Living Things Are Made of

What is this living material which can multiply itself? Scientists call it protoplasm. It is the stuff out of which all living things are made. Protoplasm is a jelly-like substance, or material, composed mostly of water. It is made up into tiny molds called cells. The bodies of plants, animals, and human beings are clusters of thousands of such cells. But each one began as a single cell.

An acorn, for example, contains one cell filled with the living material we call protoplasm. When the acorn is planted in the soil and watered, the one cell soon

From *All the Children*



What is the principal difference between the material with which this boy is building a tower and the materials out of which his body is being built?

divides through the middle to make two cells. Each of these cells divides again to make four cells. The cells continue to divide until a complete little oak tree is formed. Some of the cells are grouped together to make the roots of the tree. Some of them form the stem and the leaves. The cells on the outside of the plant change into bark to protect the living cells on the inside. Groups of cells are formed to carry on everything which goes on in the tree, such as the carrying of water and food to all its parts.

The human body begins with one cell, just as plants begin with one cell. This one cell divides and redivides until at last a complete body is formed. One group of cells forms a tough outer coating of skin to protect the soft cells on the inside. Other cells make bone to form the framework of the body. Long slender cells form the muscles. Groups of cells, such as bone cells and muscle cells, which are fitted to do a special kind of work in the body are called tissues. The little body of a baby grows into the body of a man or a woman because the cells in the baby keep on dividing—first to make a small child, then a schoolboy or a schoolgirl, then a youth, and finally a grown-up person. When growth in size stops, the cells must still divide to make new cells to take the place of those which are worn out, but they do not divide so rapidly.

Most of us have watched the building of a house, and we know the bustle which goes on while the house is being built. Some men are mixing cement. Some are pouring it. Others are running about with wheelbarrows bringing supplies to the men who are doing the work of building. But when the house has been completed, the bustle stops. Now and then we may see someone on the roof or on a ladder working to make necessary repairs, but never again do we see the tremendous activity which went on while the house was being built. While boys and girls are growing, all their

body cells are very active because building is going on. The cells are dividing again and again, to add to the amount of living material in the body. This makes the body grow bigger and bigger. At the same time some of the cells wear out and die, and these cells must be replaced while the building is going on. Since a living body is a cluster of cells, we shall have to find out what the cells need for life and health and growth, if we are to discover what the body as a whole needs to grow properly and to be strong and healthy.

"

Building time for houses and growing time for bodies are very busy times

© G. A. Douglas, from Gendreau

WHAT THE CELLS NEED FOR GROWTH

When we cut apart an acorn or any other large seed, we find that it is packed with a tough, thick substance. If the seed has not begun to sprout, we cannot find any signs of life. We cannot see the one tiny cell which makes it possible for the acorn to become an oak tree some day. Why is a seed so many times larger than the living cell it contains? What is the substance with which the seed is packed? In order to divide, even once, a cell must have food and water. If we could take a single living cell and place it on a table, the cell would very quickly shrivel up and die. But if we placed this cell in a drop of water containing the food it needed and kept the water warm enough, the cell would soon start to divide to form new cells.

The substance with which each seed is packed is food for the living part of the seed. This food makes it possible for the single living cell to start dividing. There is enough food to last until the little new plant forming inside the seed has grown the first roots and leaves which will enable it to get food for itself. When we eat the seeds of plants, as we do when we eat bread or cereal, green or dried peas, or the kernels of nuts, we are eating the food which the plant packed about the cell.

The water which the living cell in a seed needs in order to grow is supplied mostly by moisture in the earth in which the seed is planted. In an egg, which contains the single cell from which a baby chicken or a baby bird grows, the water is packed inside the shell along with the food supply for the cell.

Just as soon as a new plant has used up all the food packed in the seed by the plant on which it was formed, it must get food for itself. If it cannot do this, it will die; for all living cells must have food to live as well as to grow.

The plant gets food and water through its roots and leaves. Human beings take foods and liquids into the body through the mouth.

No one food contains all the materials which all the cells need for life and health and growth. Milk comes the nearest to being a perfect food, but even milk does not contain certain necessary substances. We must eat many different kinds of food in order to supply the cells of the body with all the different food materials they need.

Living cells also need air. Air is a mixture of several different colorless substances, each one of which is a gas. Plants take in from the air through their leaves the gases which their cells need. The human body takes in air by breathing it into the lungs. The special gas in the air which the body cells need is called oxygen. You are breathing it now. Without oxygen the body could not use the food you eat. It is very fortunate that the earth is surrounded by air containing oxygen. Without it animals and people could not live. Scientists know that there is no air surrounding the moon. This is why they are sure that no living thing, no blade of grass, no trees, no flowers, no beasts, no birds, no boys or girls live on the moon. Around and around our world it spins, a huge ball of rock which does not know the wonder of life because it does not have the gift of air.

Have you ever noticed that plants growing in a window always lean toward the sun? Without sunshine plant cells could not live and grow. They use sunlight in building their tissues. Of all the living things on earth plants alone have the power to do this. Animals and human beings get the energy to live, grow, work, and play from the stored sunlight in plants and their seeds or in the flesh, eggs, and milk of animals that eat plants. Part of almost everything we eat is stored sunlight.

Even if the sun were not the source of all life, how sad and unhappy we should be without it. To be shut away from the sun forever is one of the worst of all punishments. Men used to build dungeons far beneath their castle walls in which to shut up prisoners. Although the prisoners could live without sunlight, life for them was worse than death. Long before scientists had discovered that we live and move because food supplies us with energy from the sun, people loved the sun as the giver of gifts—the gift of warmth, of light, of the green spring, and of the golden summer. They learned to cut holes in their houses of mud and straw to let in the sun. And so today we have windows to flood

Why are plants growing indoors usually placed near a window?

Steven A. Coons

our homes with sunlight. We like to be outdoors in the sunshine on pleasant days. We love to feel the warmth of the sun on our hands and faces. We too think of the sun as a giver of gifts.

Plants are rooted in one spot. They cannot move from one place to another as animals and human beings can. Plant cells move only in growing. But there are certain cells in the human body, called muscle cells, which supply us with moving power. They do all the work of the body. The more they work, the stronger they grow.

For human beings growing up means growing in strength as well as in size. A jellyfish grows from a single cell into a big flabby mass. A clam grows from a single cell into a soft pulpy creature with strongly developed muscles only at the hinges of its shell. But a human baby must develop hundreds of muscles before he can pull his body upright and walk. As he grows older and begins to do all sorts of things which require skill, such as writing, skating, jumping rope, and playing games, he must develop hundreds of other muscles. The only way in which all these muscles can grow in strength and skill is through use. We give the name *exercise* to the act of using the muscles. The more exercise we give to the muscles, the stronger they will grow.

From the beginning of our world there has always been day and night. Day has always been the time of greatest activity—green plants like busy factories spinning sunlight into their tissues, birds and plant-eating animals seeking their food, man with the warm sun beating on his back making a place for himself as master of all other living creatures. For hundreds of thousands of years, when the sun went down, a great stillness fell over the earth. The children of the sun were resting from their labors. They were asleep. Only creatures of the night, the beasts and birds and insects that hunt for food in the darkness and sleep by

day, disturbed the peace and quiet of the sleeping earth. Sleep at night is a habit learned by the cells of the human body through thousands of years of practice. In sleep the cells of the body have a chance to grow. During the daytime they are kept busy supplying the energy necessary for work and play. During sleep, breathing and the beating of the heart slow down. The muscles which move the bones have little or no work to do.

The body cells then have leisure to divide in order to replace worn-out cells and to add the extra ones which make the human body grow in size. We know that a little baby sleeps almost all the time. While he sleeps, he grows. The older he becomes, the less sleep he needs; but until he is grown up, he must have more sleep than people who are as big as they will ever be. It has been said that sleeping time is growing time.

Galloway

Another way to give the cells enough time to grow is by resting after work or play. Even boys and girls with youth and strength need to rest when they are tired. They cannot go on working their cells and producing new ones unless they not only sleep but rest. A good time to rest is just before mealtime after one has been playing hard. A tired body cannot digest food well. If one is overtired it is hard to go to sleep at night.

"How much have I grown?"

HOW DO YOU KNOW YOU ARE GROWING?

Boys and girls cannot see themselves growing; but there are ways of finding out whether they are growing. One measure is clothing. You know that you outgrow your suits or your dresses and your shoes. Last year's coat is too short in the sleeves. Last year's skirt is above, instead of below, the knees. Last year's shoes pinch. Often clothes are outgrown before they are worn out.

Other measures of growth are the scales and the measuring rod. As the body grows, it becomes heavier and taller. If you gain several pounds and add two or three inches to your height each year, you know you are growing.

If you fail to gain in weight over a period of three months, it may be that you are not giving your body cells what they need for growth. Or something may have gone wrong in your body which makes proper growth impossible. The first thing to do, if you are not growing as you should, is to have a doctor give you a physical examination. He will find out whether you have enlarged or diseased tonsils or a diseased adenoid or decayed teeth or any other trouble which is hindering proper growth. Boys and girls in most schools are examined by a doctor every year to make sure that they are free to grow if their bodies have proper care.

Another way of finding out that you are growing is to ask yourself whether you are gaining new skill and knowledge as the months go by. Do fifth-grade arithmetic problems now seem easier to you? Can you pitch a ball straighter and with more force? Have you learned some new sport, such as swimming or skating? Or can you swim or skate better than you could last year? Are there many things you can do to help at home that you could not do when you were younger?

ARE YOU DOING YOUR BEST TO GIVE YOUR BODY WHAT IT NEEDS FOR GROWTH, HEALTH, AND STRENGTH?

Do you drink milk with each meal?

Do you eat a variety of foods every day?

Do you drink at least six glasses of water a day?

Do you play out of doors in the sunlight every pleasant day?

Do you sleep at least ten hours every night?

Do you weigh yourself every month and have someone measure your height every six months? Are you gaining in weight and height?

Do you help the doctor when he gives you a physical examination by answering all his questions cheerfully and by doing what he tells you to do?

Do you enjoy learning new things?

Do you help cheerfully at home?

Do you depend on yourself as much as possible?

1. Supply the missing word or words in each sentence below the box, using the word or words from the box which complete the sentence. (*Do not write in the book.*)

water	energy	plant-eating	protoplasm
height	oxygen	physical examination	food
muscles	sleep	exercise	plants
milk	cell division	weight	

a. The living material out of which the cells of the body are made is __?__.

b. The body grows by __?__ __?__.

c. All cells must have __?__ and __?__ in order to live and grow.

d. The one food which furnishes the cells with almost all the building material they need is __?__.

e. A gas called __?__ is necessary for life.

f. Animals and human beings get the __?__ to live and grow and move from __?__ or __?__ animals.

g. The work of the body is done by the __?__.

h. We must have __?__ in order to grow strong.

i. The cells of the body grow fastest during __?__.

j. Regular gain in __?__ and __?__ tells us we are growing.

k. By having a __?__ __?__ each year, we can find out whether anything is making it impossible for us to grow properly.

2. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. Growing is building a living body out of living material.

b. The human body is a cluster of cells.

c. All the cells of the body do the same kind of work.

d. Every many-celled plant and animal began life as a single cell.

e. A seed contains nothing but the single cell from which the plant grows.

f. We could be strong and healthy all our lives by eating only bread and water.

g. Plants grow best in the dark.

h. As people can live in the dark, it is useless to let sunlight into houses.

i. Oxygen is a colorless liquid.

j. Human beings cannot live long without air.

k. Exercise makes the muscles grow stronger.

l. Grownups need more sleep than children do.

m. Gain in weight and height is a sign of growth.

THINK ABOUT THESE QUESTIONS

What is the use of growing up? You might like to talk this question over in class. Here are further questions which may help to guide your thinking. What benefits are given to man by the growing up of plants and animals, such as grain plants, vegetables, fruit trees, cows, horses, chickens? What can many mature, or grown-up, plants or animals give us which the young plant or animal cannot give? What are some of the things men and women can do that boys and girls cannot do? For example, could a ten-year-old boy fly an airplane across the Atlantic, as Lindbergh did? Would Admiral Byrd have taken a young boy to Little America? Could a ten-year-old girl have done what Florence Nightingale did? Do you dream of things you would like to do? Can you do these things now, or do you think "This is what I shall do when I am a man or a woman"?

Have you ever thought that what you do now will help you to do what you would like to do when you are grown up? Will good health help you? Will the knowledge you gain in school help you? Will the character you are forming now help you? If so, how will they help?

Do boys and girls have to wait until they are grown up to have adventures? Do you know of children who have had great adventures? Can we have adventures and show our courage in ordinary everyday life? Is making a new friend an adventure? Is a pleasant surprise an adventure? Is learning something new an adventure? Does it take courage sometimes to go to the dentist? Does it take courage sometimes to tell the truth?

DO THESE THINGS

1. Get a number of beans or corn kernels or other fairly large seeds. Fill two boxes or flowerpots with sawdust and one with earth. Perform the following class experiments:

Experiment A. Cut open one of the seeds and examine its contents. Then plant a few seeds in damp sawdust in one of the boxes or flowerpots and place it near the window. Keep the sawdust moist. When the first green shoot appears, pull up the plant and examine the seed clinging to the root. Compare it with an unplanted seed. What has happened to the planted seed? What does this experiment prove?

Experiment B. Plant a few seeds in the sawdust of another box or pot and a few in the one containing earth. Place both near the window and keep the sawdust and earth moist. Let the plants in each box or pot grow for some time and then note the progress they make. The sawdust contains no nourishment, or food, for the seeds. The earth contains plant nourishment. What makes the difference between the plants in the two boxes?

2. Choose the game, sport, or occupation in which you are most interested. What person or team was the champion in that sport or game last year? For example: Which baseball team was the champion? Which football team? Which rowing crew? Who was the champion tennis player?

the best swimmer? the best ice skater? the best runner? What is the name of a great living artist? piano-player? violin-player? writer? Who grew the most corn to the acre and who raised the prize cow?

Find out all you can about the champion team or person you have chosen. What sort of training led up to winning the championship?

3. Hold your nose shut and close your mouth. Time yourself to find out how soon you must take a breath. How many hours go by between your breakfast and lunch and between your lunch and dinner? How often do you take a drink of water? How many hours go by between waking and sleeping? Which one of the needs of the body cells is the most continuous need?

4. Here is a table which gives the hours of sleep needed by young people of different ages:

Age	Hours
At birth	20 to 22
At 6 months	16 to 18
At 1 year	14 to 16
2–5 years	13 to 15
6–7 years	12
8–10 years	11
11–12 years	10 to 11
13–15 years	10 to 11

Explain why it is that a different number of hours of sleep is needed at different ages. How much sleep do you need? Keep a record for one week of the time you spend in sleep each night, and compare it with the table.

5. Make a chart like that on page 19 and start keeping a record of your weight and height. Weigh yourself each month and have your height measured every six months. Notice how much you gain in weight each month.

GROWING UP

(Do not write in the book.)

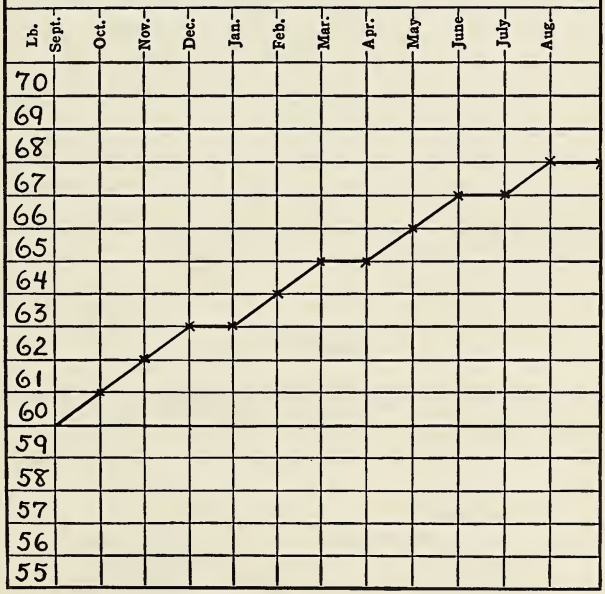
NAME_____

DATE OF BIRTH_____AGE AT NEAREST BIRTHDAY____

_____ 19_____ TO_____ 19_____

I Am Gaining in Height and Weight

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
Height												
Weight												
Gain in Weight												



6. A single cell is so tiny that we cannot see it with the eyes alone. We must use a microscope to see it. There are many plants and animals that are made of one cell only. If you have a microscope in your school, you may be able to examine some of the very small animals that have only one cell. In order to do this you will need to get the help of your teacher or the science teacher in your school.

It is not always easy to grow these tiny forms of life. The best way to do it is to put some hay or some dead leaves from a pond or brook into a jar of water from a pond. Let the water stand for about two weeks. A scum will form on top of the water. Take a drop of water from the bottom or sides of the jar and look at it through a microscope. With your teacher's help you may be able to see in the drop of water some of the tiny animals that are made of only one cell. If you find them, watch them carefully to see what they do. You may even see one little animal divide in half to make two instead of one.

Forms of life that are only single cells increase in number by cell division, just as the body of a human being, which is made of many cells, grows from a single cell by the process of cell division.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

oxygen	substance
continuous	gas
tissue (of the body)	cell division
replace	protoplasm
framework	leisure
mature	activity
bustle	experiment

2. Choose a word from the list of words on page 20 to complete each of the following sentences. (*Do not write in the book.*)

a. Protoplasm is the living __?__ of which the body cells are made.

b. The __?__ in which Roger is most interested is baseball.

c. The builder used oak boards for the __?__ of Mr. Brown's new house.

d. Mr. Adams used the __?__ time he had before supper to read the evening paper.

e. Parents are __?__ people.

f. The __?__ ringing of his alarm clock finally awakened Paul.

g. Jim and Betty earned the money to __?__ the window they had broken playing ball.

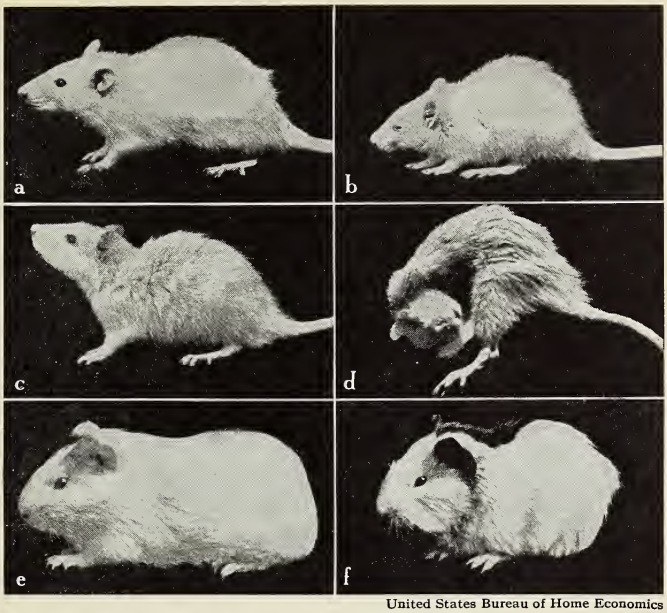
UNIT II

The Food Needs of the Body

The home of the animals whose pictures are on page 23 was in a science laboratory. You know what the first part of the word *laboratory* means. Labor is work. A science laboratory is a place where scientists work to find out whether they have the right ideas or the wrong ideas about the things they are studying. They make tests called experiments. The two guinea pigs in the picture, marked *e* and *f*, took part in one of these tests. They are brothers. They were born at the same time. Why is one of the little guinea pigs plump and bright-eyed? Why is the other so thin and weak? The food these guinea pigs were given to eat is what makes the difference in the way they grew and the way they look. The plump little guinea pig had milk, orange juice, and raw green vegetables to eat. The thin, weak little guinea pig had none.

The big healthy white rat marked *a* in the picture and the little blind rat marked *b* were born at the same time. The big rat had milk, green and yellow vegetables, cod-liver oil, and egg yolk to eat. The little blind rat had none. The food they had to eat is what makes the difference in the way the rats grew and the way they look.

The big healthy white rat marked *c* and the sick little rat marked *d* were born at the same time. The healthy rat was fed whole grain. A grain kernel that has its brown outside coat left on is called whole grain. The sick rat was fed with grain from which the brown outer coats had been removed. The food the two rats ate made the difference in the way the rats grew and how they look.

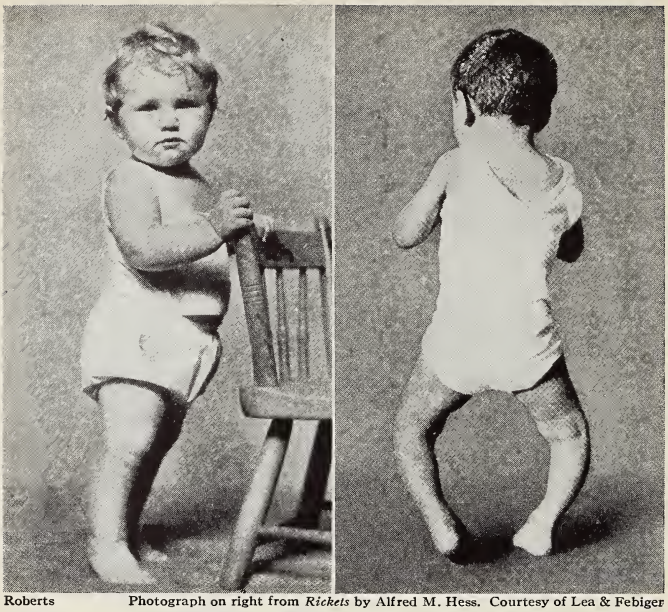


United States Bureau of Home Economics

The food they had to eat made the difference between the animals in the first column and those in the second column

"

The two children in the picture on page 24 are about the same age. How straight and tall the one at the left stands. But what is the matter with the other child's legs? They bend out like bows. The tall healthy-looking child had plenty of milk to drink. He had cod-liver oil in the winter-time. His mother took him out in the sunshine every pleasant day. The other child did not have enough milk. He never had any cod-liver oil. He did not get much sunshine. The kind of food these children ate and the amount of sunlight they got made the difference in the way they look and how they grew.



Roberts Photograph on right from *Rickets* by Alfred M. Hess. Courtesy of Lea & Febiger

What made the difference between these two children?

Food is the raw material of the human body. It supplies the substance out of which the body grows and repairs itself. It furnishes the fuel which is burned in the body to keep you warm and to give you the energy for work and play. It provides the special materials that make it possible for your body to do many different kinds of work. No wonder food makes a difference in the way you look and how you grow!

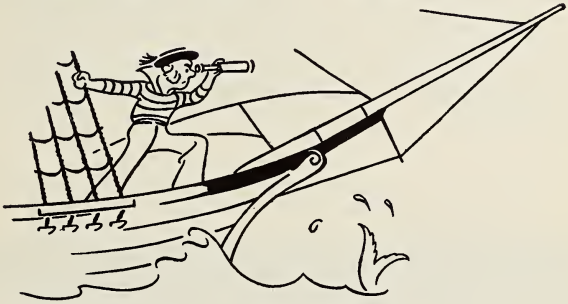
DO YOU KNOW

What there is in food that gives you the energy to play and work?

What a calorie is?

What materials in food cannot burn?

Why English sailors are called "limeys"?

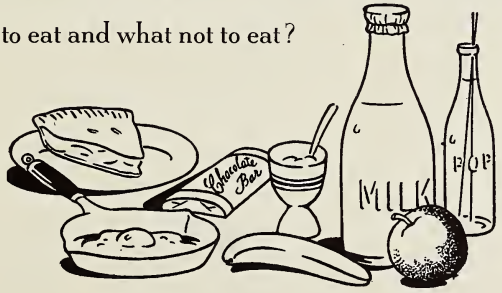


What vitamins are?

How to plan a good breakfast, lunch, and dinner?

What drinks do not give you your money's worth?

What to eat and what not to eat?



We all know that food will burn. Toast burns when we forget to watch it. A cake will burn if it is left too long in a hot oven. Food boiling on the stove burns when the heat has evaporated all the water in the pot. The parts of the food that burn outside the body are the parts that burn inside the body. The principal fuel foods are the fats and the carbohydrates. There are two kinds of carbohydrate foods, sugar and starch. The burning of sugar, starch, and fat inside your body keeps you warm and gives you the energy to move, just as the burning of wood, coal, oil, or gasoline produces heat and supplies the energy which makes an engine go.

Measuring the Fuel Value of Foods

Have you noticed that exercise makes you warm? This is a proof that the muscles are using food as fuel. The amount of heat given off by different foods is measured by a heat unit called a calorie. The calorie used in measuring the fuel value of foods is the amount of heat it takes to make one pound of water four degrees hotter. The calorie is a unit used in measuring heat, just as an inch or a foot is a unit used in measuring height and length and width and a pound is a unit used in measuring weight. Foods are burned in the laboratory to find out how many calories they give off. Boys and girls of different ages and weights are studied to find out how many calories they use in doing different things. By measuring the number of calories in different foods and the number of calories your muscles use each day, you can find out how much food you will need to eat each day in order to supply your body with the amount of fuel it needs.

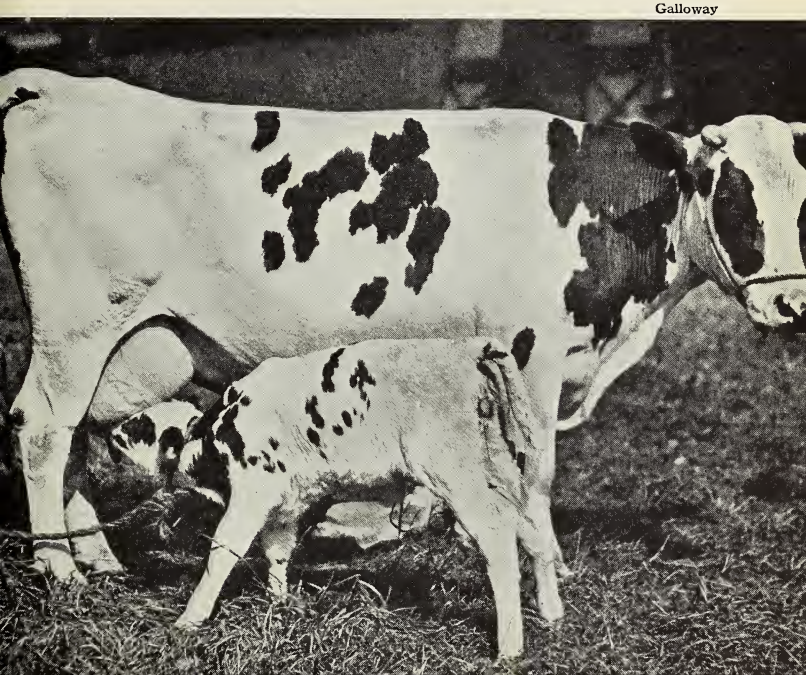
In the table below you will find the number of calories you use a day in living, growing, working, and playing. It is necessary to take in about this number of calories a day. You cannot spend pennies unless you have them to spend. You will not have enough calories to spend for all your activities unless you take in enough calories in the food you eat.

Daily Calorie Needs

Age Years	Calories Boys	Calories Girls
9–10	1700–2000	1550–1850
10–11	1900–2200	1650–1950
11–12	2100–2400	1750–2050
12–13	2300–2700	1850–2150

All the food materials this two-day-old calf needs to grow on are found in the mother cow's milk

Galloway



The foods in your daily diet that contain the most calories are the foods that are rich in fat, sugar, or starch. Such foods are potatoes, cereals, bread and butter, fat meats, sweet fruits, and the sugar, honey, and molasses which are used as sweetening. However, all foods will burn, and so all foods contain a certain number of calories.

FOODS FOR GROWTH

Have you ever put into a fire a piece of wood containing nails? If so, you know that the wood burns but the nails do not burn. You can rake the nails out of the ashes after the fire is out. There is a food material which is like a board

"A quart of milk a day—don't forget!"

Doris Day

full of nails in that it contains substances which will burn and also substances which will not burn. This food material is called protein. The principal fireproof substance it contains is called nitrogen. About four fifths of the air is made up of nitrogen in the form of a gas. Friendly germ plants in the soil, called bacteria, take nitrogen from the air and change it into a form that the plants can use as food. From plants, animals manufacture most of the proteins you eat every day. The body cells use the nitrogen from protein food as building material.

All the protein materials needed in cell-building are found in milk. You can understand this when you remember that for several weeks after a calf is born it lives entirely on its mother's milk. Cow's milk must contain all the protein materials necessary for the calf's growth. Babies double their weight in the first six months of life on their mother's milk or on cow's milk. As cheese is made of milk, it also is a good protein food. Next to milk, eggs are the best source of protein for growing boys and girls. The body of a baby chicken grows from a single cell inside the eggshell on the food material in the egg. The white of the egg is almost pure protein. It is often called albumin. Lean meat of all kinds and fish are also rich in protein.

Almost all foods contain water. You know that water will not burn. Water is another fireproof body-building material. The body also uses water in most of its activities. People can go for forty days without food but not more than forty-eight hours without water. And yet the body is always losing water. By breathing on a mirror you can see the water which leaves the body by way of the lungs. Sometimes, when you are hot, you can see the water which is always leaving the body through the skin as sweat, or perspiration. You know that water leaves the body by way of the kidneys and the bowel when you get rid of body

wastes. To make up this loss of water it is necessary to drink at least six glasses of water every day. Some of the water supply of the body also comes from food, especially from milk, green vegetables, and fruits.

When all the water has evaporated from the food placed over a fire, the food starts to burn. If it is allowed to burn until it is entirely burned up, a small amount of material is left which will not burn. This material is ash. It is composed of the mineral salts in the food. Plants take up mineral salts from the soil through their roots. Although the minerals form a very small part of the weight of the plant, they are necessary to its life, growth, and health. Minerals also are necessary for the life, growth, and health of animals and human beings. Many different mineral salts are used in the body for building purposes and for other important activities. The principal ones are calcium, phosphorus, iron, and iodine. Some of these minerals are present in minute amounts, less even than one grain of salt. And yet if that one tiny grain is lacking, something goes wrong. Human beings get the mineral salts they need from both plant foods and animal foods.

FOODS FOR HEALTH PROTECTION

Have you ever been ill because of something you ate or drank? If so, can you remember what caused the sickness? Perhaps you had too many sweets. Perhaps you ate unripe or overripe fruit. Perhaps you ate or drank something which contained harmful germs. Have you ever heard of a person who became ill because he did not eat something? In the days before steamships were invented, it used to take many weeks to cross the ocean. The sailors on these voyages had little or no fresh food. They lived mostly on salt

fish, meat, and hard biscuits. Before they reached land, many of them became very ill, and some of them died. The reason they became ill was because they did not have a certain food substance in their daily food supply. The kind of illness they had is called scurvy.

Many sailors and explorers learned by experience that fresh vegetables and fruits, especially oranges and lemons, protected them from scurvy. Early in the nineteenth century lime juice or lemon juice was made part of the food supply of all sailors in the British navy, and scurvy disappeared from English ships.

Learning about the Vitamins

Although it was proved by experience that people might become ill because they did not eat something, no experiments were made to find out what this something was until the latter part of the nineteenth century. Until then scientists believed that foods were made up only of sugar, starch, fats, proteins, water, and mineral salts.

Dr. Hopkins, an English scientist, mixed an artificial food containing all these substances. He fed this food to six rats. The same food, with a small amount of milk added, was fed to six other rats. The first set of rats grew hardly at all. The second set grew rapidly. On the eighteenth day of the experiment milk was added to the diet of the first set and taken away from the diet of the second set. Immediately the first six rats started to grow and the second six rats stopped growing. From this experiment it was plain to see that milk contains something necessary for growth besides pure carbohydrates, fats, proteins, water, and minerals. What was this substance? Could it be that other foods besides milk contained it? Why was it so important to find the answers to these questions?

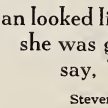
American scientists were also working on the mystery of this "something" in food which is necessary for growth and health. In one of their experiments they found that rats fed on a diet which contained lard or olive oil or cotton-seed oil as the only fat did not grow. But just as soon as the rats were given butter fat or egg yolk instead of lard or vegetable fats, they began to grow.

Many other experiments proved that there are substances in milk, butter, eggs, fruits, vegetables, whole grains, cod-liver oil, liver, and yeast which are necessary for growth and health. As these substances had no family name, a name had to be invented for them. In 1913 they were given the name *vitamins*. The Latin word *vita* means "life." Foods which contain vitamins are sometimes called *protective foods*.

In order to tell the vitamins apart, in speaking of their work, we call each one by a letter of the alphabet. We now know about the work of vitamins A, B, C, D, E, G. The scientists who are interested in studying foods are finding out new things about vitamins all the time. In the years to come there will be much more for boys and girls to learn about vitamins than there is now.

WHAT TO EAT

Joan is a good-looking intelligent girl eleven years old. Last year she had peculiar eating habits. For breakfast her mother serves a hot cereal in winter and a dry cereal in summer. Sometimes there is cocoa and sometimes milk. Apples and oranges fill a dish in the center of the table. Once or twice a week there is fruit juice in pretty glasses or stewed prunes or applesauce. Toast is made on a toaster at the table so that it can be eaten hot



Joan looked like this when she was getting ready to say, "I don't like it.

Steven A. Coons

with butter. Joan's brothers are big boys in high school. They eat so much for breakfast that their mother is kept busy filling their cups and plates. But last year Joan drank only her cocoa and ate a few spoonfuls of cereal. She did not like toast and butter, and she did not like milk unless it had chocolate in it. She liked sweet fruit juice, but she thought it a great bother to eat a whole orange or an apple.

At almost every meal there were things that Joan liked and things she did not like. If she did not like them, she would not eat them. If the main dish at dinner was something that Joan did not like, there was always a great fuss at the table. Joan became cross and everyone else became cross trying to make her eat.

Joan is very fond of candy and cookies. Whenever she had money to spend last year, she spent it on candy. When Joan ate very little for dinner, her mother knew she had been eating candy or cookies between meals.

Then Joan's teacher got two pairs of white rats. One pair of rats was fed on white bread with just a little milk. The other pair of rats had whole-wheat bread and plenty of milk. Joan noticed the big difference that food made in the way the two pairs of rats grew. She learned in school about the different ways in which the body uses food. She became interested in planning how to give her body all the different kinds of foods it needs for growth and good health.

Joan's eating habits are now different from what they were a year ago. She looks different too. Her cheeks are pinker, and her muscles are stronger. She likes to play outdoors with boys and other girls instead of moping around in the house.

,,,

Now Joan looks like this when she eats her breakfast

KODACHROME BY STEVEN A. COONS

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Planning Meals

In planning meals it is a good idea first to make sure that you have provided for a quart of milk, one cooked and one raw green or yellow vegetable, and two kinds of fruit in your day's meals. These foods will give you the protein, minerals, and vitamins that are necessary for growth and good health. Then you may add another good protein food besides milk (meat, cheese, eggs, dried peas, or dried beans) and the foods that are rich in calories, such as potatoes, bread and butter, and cereals.

You have learned the number of calories you need each day. You may divide up among the three meals the number of calories you need. On pages 255 to 256 of this book you will find listed the helping of various foods that will supply you with 100 calories. You may use this list in planning meals.

The longest period between any two meals is between dinner or supper at night and breakfast in the morning. In order to have enough calories to spend in the morning it is necessary to eat a breakfast that will supply you with about 700 calories. You may start to build up your breakfast with bread or cereals and milk. You have learned that milk contains the best proteins for growing boys

Steven A. Coons

A good breakfast.
How many calories
does it supply?

and girls. It is the best source of the minerals calcium and phosphorus which are used in the body for building bones and teeth, and it is rich in vitamins A, B, and G. A glass of milk (one half pint) will supply you with 170 calories. If you want a warm drink, a cup of cocoa, half milk and half water, will supply you with about the same number of calories as a glass of milk.

A slice of whole-wheat bread one-half inch thick contains 100 calories. Whole-wheat bread contains vitamin B and minerals as well as calories. Four slices of bread, each one-half inch thick, or eight slices, each one-quarter inch thick, will give you 400 calories. The remaining 130 calories may be supplied by the butter used to spread the bread. One level tablespoonful of butter furnishes 100 calories. Butter is rich in vitamin A. It also contains a small amount of vitamin D.

Instead of making your breakfast only of bread and milk or cocoa, you may substitute a cereal for part of the bread and butter. Three quarters of a cup of dark cereal will give you 100 calories. A little over half a cup of whole milk will add another 100 calories, and one level teaspoon of sugar will give you 20 more.

If you may have more for breakfast than milk, bread, butter, and cereal, the best food to choose is tomato juice or a citrus fruit, such as an orange or half a grapefruit. This fruit will supply you with vitamin C. An orange, or a cup of orange juice, will give you 100 calories. A cup of tomato juice is worth 50 calories. If you may have an egg for breakfast, either poached or soft boiled, this will give you 70 calories. Eggs are valuable for protein, the mineral iron, and vitamins A, B, and G. The fruit and the egg may be substituted for part of the bread. You may plan the other meals of the day much as you plan your breakfast.

Orangeade
HEALTH
0
1
2
3
4
REFRESHING

The Cost of Food

In buying food, as in buying anything else, people like to get their money's worth. Sometimes it is necessary for a family to make careful plans for spending the food money. Milk should always be planned for first, since it is necessary for everyone and is, moreover, the best building food for boys and girls. Dried and evaporated milk have the same food value as bottled pasteurized milk and in some places may cost less. One tall can of evaporated milk is equal to one quart of pasteurized bottled milk. One pound of whole dried milk equals four quarts of pasteurized bottled milk.

Bread and cereals supply calories at low cost. Whole-grain breads and cereals cost about the same as white bread and hominy but are richer in vitamins and minerals. Home-cooked cereals are usually less expensive than ready-to-eat cereals. Cabbage, onions, and carrots can be bought all the year round and are usually cheap. A dish made of eggs, dried beans or peas, or macaroni and cheese is less expensive than meat and may be used instead of meat on some days. Canned tomatoes may be used in place of oranges or grapefruit as a good source of vitamin C. Vegetables and fruits are canned so carefully nowadays that the minerals and vitamins they contain are not lost in canning. They are often better than home-canned vegetables and fruits. People who live in the country and who cannot get fresh vegetables and fruits from the store in the wintertime may use canned or dried vegetables and fruits instead.

Too Many Pounds

When people take in more money than they need to spend, they may put what they do not use in a bank to save it. When you take in more calories than you use right

away in living and growing and in working and playing, they are stored in the body as fat. A certain amount of extra fat is like having money in the savings bank. You can draw on it in case you are obliged to skip a meal or need extra fuel for hard exercise or become ill and cannot eat much. But a great many extra pounds of fat may be too great a burden to carry about.

Which scale tells the best tale?

A boy named Jim weighed a great deal too much for his height and age. When Jim played outdoor games, he tired more quickly than his friends did. His mother took him to see a doctor. The doctor asked Jim what he had had for breakfast that morning. Jim said that he had had a dish of prunes, three pancakes with two lumps of butter and sirup, and two cups of cocoa with two teaspoonfuls of sugar in each. This is how the doctor figured out the number of calories Jim's breakfast contained.

Jim's Breakfast

	Calories
Four prunes, stewed and sweetened, with juice	200
Three pancakes	300
One and one-half tablespoonfuls of maple sirup	100
Two tablespoonfuls of butter	200
Two cups of cocoa	340
Four teaspoonfuls of sugar	80
	1220

Just for breakfast Jim had taken in more than half the number of calories he needed for the whole day. His other two meals brought up his total calories to more than 3000. The doctor and Jim and Jim's mother planned meals that would help Jim to lose some of his extra pounds.

Boys and girls should never try to lose weight without asking a doctor to help them. Overweight may be caused by other things besides eating foods that are high in calorie value. People who try to become thinner may stop eating foods that their bodies need for health and growth. It is dangerous to take anything advertised as a "cure" for overweight. A product of this kind may contain harmful drugs.

Too Few Pounds

Boys and girls who are a great deal too thin for their height and age, or who tire easily and have weak flabby muscles, may not be eating enough food, or they may not be eating the right kinds of food. They may not be getting enough rest at night and during the day. They may be eating too fast and not chewing their food well. They may have decayed teeth or diseased or enlarged tonsils and adenoids. A boy or girl may be too thin for any of a number of reasons. A doctor is the one who can find the correct reason. This is why an examination by a doctor is the first thing to have if a boy or girl is undernourished. The doctor will give directions for the next step to be taken.

WHAT NOT TO EAT

You have probably been told many times that you should eat candy, cookies, cake, and other sweets only for dessert after a meal. Can you think of any reasons why this is good advice? Compare candy with fruit. The candy

contains only sugar. It has no vitamins and no minerals. It can be used by the body only as fuel. Sweet fruits, on the other hand, are rich in vitamins and minerals as well as sugar. Tom and Alice took box lunches to school. Their mother gave each of them two cents every day to buy a dessert. Alice always bought candy. Tom bought a banana or an apple. Which one made the wiser choice?

Foods highly seasoned with salt or spices are apt to irritate the lining of the stomach. People who are in the habit of eating rich spicy foods or fried foods which are coated with fat often have indigestion. This means that the stomach is so irritated that it frequently aches. Some other signs of indigestion are a disagreeable burning in the throat and an uncomfortable feeling of fullness in the stomach.

Most soft drinks, such as orange pop, soda water, and ginger ale, are made out of water which has been flavored, sweetened, colored, and mixed with gas to make it bubble. Water is free. All that you get for your money when you buy a soft drink is a pleasant flavor. Drinks made of pure fruit juices, such as lemonade or orangeade, and drinks made with milk, such as a malted milk shake or cocoa, not only have a delicious taste but also supply you with the food materials your body needs for growth and health protection.

How many soda fountains are there in your neighborhood? Is there one at which the drinks are sold in paper cups? If so, this is the soda fountain to choose when you wish to buy a drink. At many soda fountains the cups and glasses are not washed properly. Have you ever seen a clerk at a soda fountain pick up an empty glass from the counter, rinse it in lukewarm water, wipe it with a damp cloth, and immediately fill it again for the next customer? Cups and glasses are used over and over again at a soda fountain. Unless they are washed in clean hot soapsuds,

Lewis W. Hine and Cleanliness Institute

Unsafe dishwashing at a soda fountain.
How must dishes be washed to make them safe for the next user?

rinsed with boiling water, and wiped with a clean towel, or dried with hot air, living disease germs may be carried from the lips of one customer to the lips of another.

Two Whips

Coffee and tea are beverages which many grown-up people find pleasure in drinking. Why are they not good drinks for growing boys and girls? In the first place coffee and tea contain no substances which the body can use except water. A glass of water has exactly as much value as

nourishment as a cup of coffee or tea. The effect of coffee and tea is explained by the fact that these drinks contain drugs which speed up the action of the heart. They may be compared to the whip with which a man beats a horse to make the animal go faster. Growing boys and girls do not need to have their bodies whipped into action. If they drink coffee or tea, instead of milk or milk drinks, they are cheating their bodies of the nourishment which the milk and milk drinks contain. They are also apt to have "jumpy nerves," just as a horse or a dog is apt to be nervous if it is often whipped.

ARE YOU DOING YOUR BEST EACH DAY TO EAT FOODS WHICH SUPPLY THE FOOD MATERIALS YOUR BODY NEEDS?

Do you eat a good breakfast?

If you have a school cafeteria, do you choose for lunch some foods which are rich in vitamins and minerals, such as milk, cocoa, cream soups, green-leaf and yellow vegetables, and fruit?

Do you eat candy and other sweets only after meals, so that you do not spoil your appetite for growth foods?

Do you drink milk, milk drinks, and fruit juices instead of coffee, tea, and soft drinks?

TRY THESE TESTS

1. Write down all the names for the different food substances which the body uses for growth and repair, heat and energy, and health protection. Under each food substance write two foods which are especially rich in this substance.

EXAMPLE. *Protein*
Milk
Eggs

2. Which of the following practices are wise? Which are foolish? Give the reason for each choice. (*Do not write in the book.*)

a. Choosing fruit instead of candy when you desire something sweet.

b. Asking to have your egg boiled, poached, or scrambled instead of fried.

c. Choosing orangeade or lemonade or some other drink made of pure fruit juice or milk when you go to a soda fountain.

d. Eating no vegetables except potatoes.

e. Eating all your salad except the lettuce.

f. Choosing whole-grain bread instead of white bread when you have a choice.

g. Spreading mustard on cheese or meat sandwiches and eating them with pickles.

h. Drinking milk or milk drinks instead of coffee or tea.

3. Choose the best ending for each of the following sentences. (*Do not write in the book.*)

a. The foods which furnish most of the minerals and vitamins that the body needs for growth and health protection are · (1) white bread, coffee, tea, and sugar · (2) whole milk, fruit, green and yellow vegetables, eggs, whole grains, and liver (3) salt meat or fish, candy, soda crackers, ginger ale, pickles, and frankfurters.

b. A good breakfast consists of · (1) an orange, a dish of oatmeal with whole milk and one spoonful of sugar, two slices

of toast with butter, a soft-boiled egg, and a glass of milk (2) a cup of cocoa and two slices of white bread with butter (3) coffee cake, a fried egg, and two cups of coffee with cream and sugar.

THINK ABOUT THESE QUESTIONS

1. Do you ever refuse foods at home because you do not like them? Why should you try to think of ways in which you can learn to like the healthful foods which you do not like now?

2. Why is it that dentists often tell their patients to drink milk or eat cheese? Why do doctors often ask mothers to give babies cod-liver oil and to keep them in the sun for part of the day? Have you ever heard cod-liver oil called bottled sunshine? Why is it given this name?

DO THESE THINGS

1. If possible, carry on an experiment which shows the effect of milk on the growth of white rats. Your teacher may help you to carry out this experiment.

2. If you have a science laboratory in your school, you may test different foods for the food substances they contain.

a. Iodine turns starch blue. Cut a slice of raw potato and put a drop of iodine on it. Does the potato contain starch? Bread and bananas also may be tested for starch.

b. Heat two or three cabbage leaves without water in a tightly covered fireproof dish. Examine the inside of the lid. Does cabbage contain water?

c. Burn up the cabbage leaves. What is left? Does cabbage contain minerals?

3. Using the table of calories on pages 255 to 256, plan a day's meals which will give you about 2200 calories. As you plan the meals, think of the protein, minerals, and vitamins you need as well as the number of calories.

4. On Monday the menu on the wall in the school cafeteria offered for sale the foods listed below.

Cream of tomato soup	$.10
Vegetable soup	.10
Lamb stew with vegetables	.25
Baked macaroni with cheese	.15
Mashed potatoes	.05
Spinach	.05
Coleslaw	.05
Creamed carrots	.05
Fruit salad	.15
Potato salad	.10
2 cream-cheese sandwiches on whole-wheat bread	.10
2 slices of white bread	.03
2 whole-wheat rolls	.03
A pat of butter	.02
Dill pickles, each	.02
Chocolate pie	.10
Frosted layer cake	.10
Baked apple	.05
A dish of prunes	.05
Dates stuffed with peanut butter	.05
Plain molasses cookies, each	.02
Milk	.05
Cocoa	.05

John brings sandwiches from home for his school lunch. In addition he has ten cents with which to buy a hot food and dessert in the school cafeteria. John has his dinner at night.

Tom buys his whole lunch in the school cafeteria. He has twenty-five cents to spend each day. Tom also has his big meal at night.

Mary's family has supper at night. She has fifty cents to spend in the school cafeteria for her dinner.

Help John, Tom, and Mary to make good choices of food for the money each one has to spend.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

laboratory	kidneys	calcium
carbohydrate	mineral salts	phosphorus
unit (of measure)	scurvy	iron
calorie	mystery	iodine
protein	Latin	irritate
nitrogen	vitamins	beverage
bacteria	protective foods	effect
albumin	citrus fruits	

2. Match each group of words in the list below with the word or words in the list above that you connect with it. (*Do not write in the book.*)

a unit used to measure heat
a drink
something that has not been explained
one-celled forms of plant life
a fireproof substance in protein
four mineral substances
oranges and grapefruit
a very old language

Chief Sources of Vitamin A

- Cod-liver oil
- Liver
- Egg yolk
- Carrots, sweet potatoes, and other yellow vegetables
- Spinach, turnip greens, and other green-leaf vegetables
- Butter
- Cheese
- Cream
- Whole milk
- Apricots and prunes

Chief Sources of Vitamin B

- Yeast
- Whole-grain breads and cereals
- Egg yolk
- Bananas, pineapples, and other fruits
- Turnip greens, cabbage, lettuce, spinach, carrots, corn, and other vegetables

Chief Sources of Vitamin C

- Citrus fruits, such as grapefruit, lemons, and oranges
- Tomatoes, fresh or canned
- Pineapples, strawberries, peaches, and other fruits
- Raw cabbage, raw carrots, and other raw vegetables

Chief Sources of Vitamin D

- Cod-liver and other fish-liver oils
- Milk to which vitamin D has been added
- Egg yolk
- Butter
- Liver
- Summer sunlight, which enables you to make vitamin D for yourself when it falls on your bare skin

Chief Sources of Vitamin G

- Yeast
- Liver
- Eggs
- Beet tops, turnip greens, cabbage, and other green-leaf vegetables
- Whole milk
- Fish, most kinds
- Meats

UNIT III

What Happens to the Food You Eat

You might write all day and still not complete a list of all the different kinds of living things there are in the world. Suppose you stop reading now and see how many you can write down in one minute. The body of each kind of living thing is made according to a different pattern. The cow eats grass, but the pattern of a cow is not in the least like the pattern or shape of grass. You eat beef, but you are not in the least like a cow. Animals and human beings have the remarkable power of changing the food they eat into a new pattern, the pattern of their own bodies.

To make a new pattern, the old pattern must be broken up. If you have a string of beads in which the colors run blue, red, green, and yellow and you wish them to run yellow, red, blue, and green, you unstring the beads and string them over again to make the new pattern. Just so your body breaks up food to get at the raw materials out of which the food is made. It weaves the proteins, minerals, and water into a new pattern, the pattern of you. It uses the fuel materials—sugar, starch, and fat—for heat and energy. And it uses the vitamins, minerals, and water to carry on other activities which are necessary for life, health, and growth.

In learning about what happens to the food you eat, you will learn also about the things you can do that will make a great difference in the ability of your body to make good use of food.

DO YOU KNOW

What happens to bread in the mouth?

How much food your stomach can hold?

The name of the longest organ in your body?

What happens to food after it has been digested?

What laughter has to do with good digestion?

How to be hungry for meals?

How improper chewing cheats the body?

Why hard exercise after a meal delays digestion?

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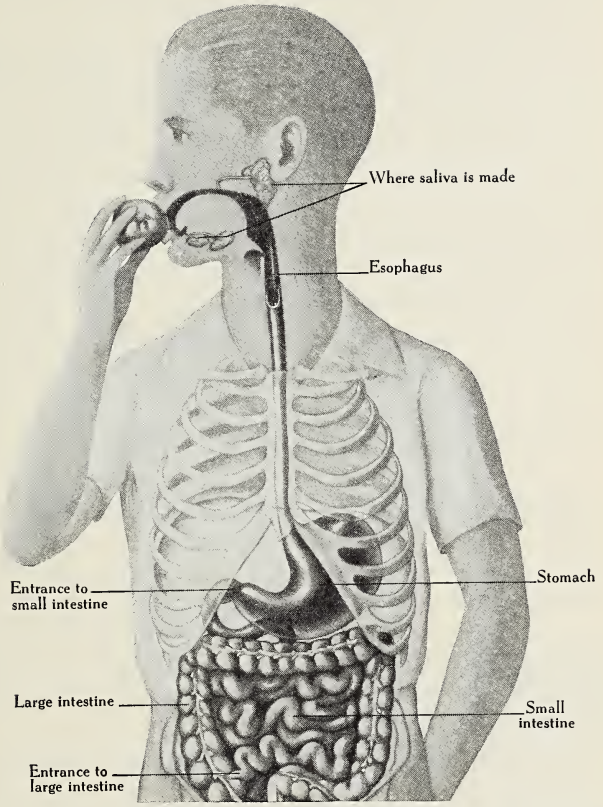
THE DIGESTIVE TRACT

Digestion is the name given to all the changes through which food must go before the body can use the materials in food for growth, repair, heat, and energy. These changes take place in a tube about thirty feet long called the digestive tract. The upper end of the tube is the mouth. The lower end is the opening of the large intestine through which you get rid of the food that cannot be digested. In this tube food is split up into the simple substances which the cells can use. These substances are dissolved in water. They can then pass through the walls of the digestive tract into the blood stream and out of the blood stream into the watery fluid, or liquid, in which the cells live. From this watery fluid, called lymph, the cells soak up the food materials which they use in all their activities.

What Happens to Food on Its Way to the Stomach

The instant you put food into your mouth, it begins to be changed into the form in which it can be used by the body cells. First, it is broken up and ground into fine bits by your teeth, and while it is being chewed it is mixed with a watery digestive juice called saliva. You are very familiar with this juice, since your mouth is always wet with it. Saliva flows into the mouth from three pairs of small organs called salivary glands. Saliva is used to moisten and soften the food so that it can be swallowed easily, and to change the starch in food to sugar. If you chew a piece of bread long enough, you will find that it begins to taste sweet. The starch in the bread is being changed to sugar by the saliva. Starch cannot pass through the walls of the digestive tract into the blood stream. Sugar dissolved in water can. Thus,



Find the different parts of the digestive tract as you read about them

right in your mouth where you can tell what is going on, digestion begins; that is, food is ground up by the teeth and partly dissolved in the water of the saliva, and a food substance that cannot pass into the blood stream begins to be changed into one that can.

After you have chewed a mouthful of food thoroughly in order to grind it up into fine bits and mix it with saliva, you swallow it. From now on everything that happens to the food happens without your knowledge. The food goes down a tube which reaches from the back of your throat to your stomach. This tube is called the esophagus. Food does not fall down this tube. It is forced down by the action of the muscles in the esophagus. Have you ever had to lean over to drink from a bubble fountain? Then the muscles in your esophagus had to force the water uphill for part of the way. Have you ever had to eat when you were lying flat on your back? Then the muscles in your esophagus had to push the food along over a level stretch.

What Happens to Food in the Stomach

Your stomach is an elastic bag. It is always the size of its contents. You know that a toy balloon is big or small according to the amount of air it contains. The stomach is big or small according to the amount of food it contains. The stomach of a boy or girl of your age can hold about one quart of food at one time.

Within a few minutes after food enters the stomach the muscles in the walls begin to move with a motion like that of small waves. From the inside lining of the stomach walls a digestive juice called gastric juice trickles out. The gastric juice splits up and dissolves the proteins in the food. The movements of the stomach walls mix the food with the gastric juice and push it along toward the lower end

of the stomach. When the food reaches this part of the stomach, it looks something like a thick cream soup. The opening and shutting of a small valve, or door, in the lower end of the stomach allows this soupy mass to escape a little at a time into the small intestine.

The length of time it takes for a meal to leave the stomach depends on the size of the meal, the kind of food eaten, and how well it was chewed. A meal which contains fried foods takes the longest. Neither saliva nor gastric juice has any effect on fat. For this reason the gastric juice cannot easily break through the coating of fat with which fried foods are covered in order to get at the proteins to dissolve them. Thus, fried foods make the stomach work overtime. The last of an ordinary meal passes from the stomach into the small intestine in from four to six hours after you began to eat.

What Happens in the Small Intestine

The small intestine is a long narrow tube which opens out of the lower end of the stomach. It is the longest organ in the body. Your small intestine is more than four times longer than you are tall. A long piece of rope will fit into a small space if the rope is wound in a coil. The small intestine is coiled up in the space below the stomach.

In the upper part of the small intestine three more digestive juices are poured into the food. Two of these juices

Why is this boy able to swallow with his head down?

begin the digestion of fats and all three finish up the job of changing the different food substances into the form in which they can pass into the blood and be used by the body. It takes nine hours or more after eating before the last of a meal leaves the small intestine. The stomach may completely empty itself between meals, but the small intestine is seldom empty. The last of the food from breakfast is just reaching it from the stomach when you start to eat lunch; and long before lunch has left the small intestine, you are eating your dinner. Some food from dinner may still be in your small intestine at breakfast time, although your stomach is empty.

Food is moved along the small intestine by the action of the muscles in the walls. Ordinarily you do not feel the movements of these muscles. But if you have eaten unripe fruit or have taken castor oil or any other food or medicine which irritates the small intestine, the movements of the walls become so strong that they may cause pain.

The lining of the small intestine looks very much like folds of velvet. Soft fingers of tissue, called villi, which are much smaller even than the silky hairs of velvet, reach out from the folds in the walls. In each one of the hair-like villi lies a network of tiny blood vessels. If you can imagine a cobweb or a fish net so tiny that it might be enclosed in a space much smaller than the inside of a single hair, you will have some idea of the minute size of these blood vessels.

Completely digested food passes through the thin walls of the villi and the thin walls of the blood vessels into the blood stream. Part of the food which passes into the blood stream from the small intestine is used at once by the cells as building material or as fuel. The rest of the food is put in storage, to be kept until it is needed. Fat which

is not used at once for fuel is stored under the skin as fat. Sugar is the principal food substance stored, and the main storehouse of sugar is the liver. In this great organ sugar is taken out of the blood and put away for use when the sugar supply of the body runs low. Sugar is also stored in the muscles.

When the body has as much sugar as it needs for immediate use as fuel and when the liver and muscles are packed as full of sugar as they will hold, part of the left-over sugar is turned into fat. Many fat people are fat because they eat a great many sweet foods and starchy foods, such as candy, bread, and potatoes.

Very little protein food is stored. The cells use it for growth and repair. Usually they have just enough for these purposes. If too much meat or other protein food is eaten, the body gets rid of it as waste. As the body stores very little protein, you can see how important it is to supply the cells with enough protein for each day's work of building and repair. The protein materials in a quart of milk are just what the cells need to make up for any lack in the proteins supplied by other foods.

Getting Rid of Waste

Fruits, vegetables, and whole grains have tough skins and fibers which cannot be digested. The part of the food you eat which cannot be digested is squeezed from the small intestine into the large intestine, or large bowel. The large intestine is only about five feet long, but it is much wider than the small intestine. Its main use is to act as a storehouse in which undigested food is held until the body can get rid of it. The waste material which collects in the lower part of the large intestine should be removed from the body every day. Have a regular time,

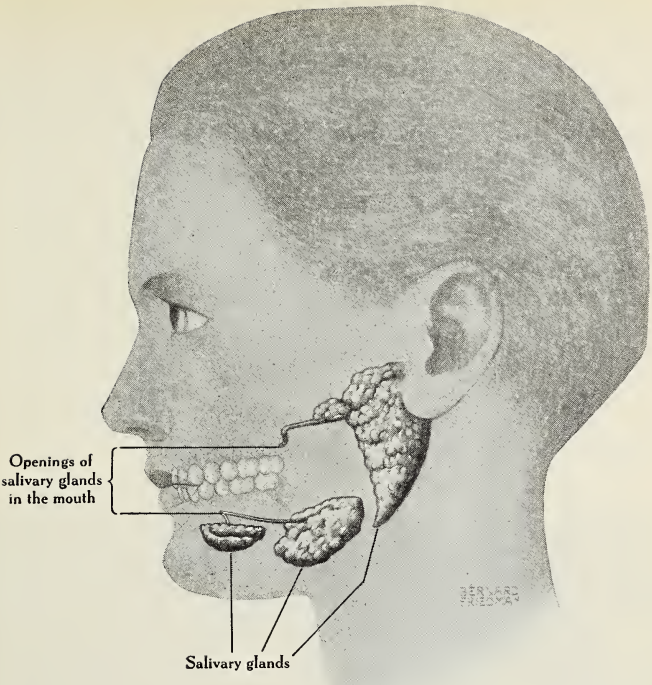
morning or night, for a bowel movement. After breakfast or before going to bed is a good time. Eating raw fruits and raw vegetables will help to supply the waste material called roughage which aids in the movement of the bowels. One should also drink plenty of water.

GETTING READY TO EAT

Usually the digestive juices are turned on full force when you begin to eat. Sometimes, however, the way you feel interferes with the proper flow of these juices. When a person has to speak in public or take part in a play, he may become so worried and anxious for fear of forgetting what he is supposed to say that his mouth feels dry. Have you ever had this experience? Have you ever been so frightened that your tongue felt as if it were sticking to the roof of your mouth? On the other hand, has your mouth ever watered when you smelled a food that you like especially or even when you just thought of it?

The flow of saliva may be turned on or off according to the way you feel. This has been known for a long time. In India when it was not known which one of several persons was guilty of a crime, rice was given to them all to chew. After chewing a short time each one had to spit out the rice upon the leaf of the sacred fig tree. If anyone spit it out dry, this was taken as proof that the fear of being discovered had stopped the flow of saliva. Therefore that person must be guilty.

What is true of the flow of saliva is true also of the flow of gastric juice. It is of course much harder to find out what goes on in the stomach than it is to discover what goes on in the mouth. But scientists have learned a great deal about digestion in the stomach. One doctor studied a little boy who had a hole in his stomach. Through



This drawing shows where the salivary glands are located

this opening the doctor could see how the stomach worked. When the boy was hungry, gastric juice began to flow out as soon as he saw food. If the food was not given to the little boy right away, he began to cry and the flow stopped. When the boy chewed food that he liked, gastric juice immediately started to flow. If he was given a tasteless piece of gum to chew, there was no flow of gastric juice.

A scientist had a dog that had a hole in its stomach. One day a cat was brought into the room before this dog was fed. The dog flew into a great rage. Then the cat was taken out, and the dog was given his dinner. Although the dog was very hungry and ate eagerly, only a few drops of gastric juice flowed out in his stomach.

These tests and many others show clearly that the flow of saliva and gastric juice is aided by the pleasant feelings which accompany the taste and smell of food during chewing or which are aroused when pleasant foods are seen or smelled. On the other hand, anger, fear, worry, tiredness, and lack of appetite all hinder the flow.

"

Sister has just told a joke she heard at school.
Can you think of one to tell during supper tonight?

Galloway

Rest and Cheerfulness

In getting ready for a meal you can aid digestion by resting beforehand, if you are tired from work or play, and by planning to make mealtime a cheerful, pleasant time. Washing your hands and face and brushing your hair before meals will give you the pleasure of knowing that you are looking your best.

Think of ways in which you can make people smile during meals. Perhaps you have heard the expression "laugh and grow fat." This means that a jolly person gets more good from his food than a person who is cross and quarrelsome. Long ago in the Middle Ages, the lords and ladies used to have jesters to make them laugh during meals. Nowadays we all know jokes and interesting stories that may help people to forget their worries for a while.

Being Hungry for Meals

Another way in which we can get ready for meals is to plan to be hungry at mealtime. Have you ever had a dull ache or gnawing pain in your stomach when you had gone without food for some time? This ache is the way your stomach has of telling you that it is ready for more food. The gnawing pain is caused by the movement of the stomach walls. It is often called a hunger pain. Eating makes the pain stop. Usually you do not go without food long enough to have real hunger pains. But if meals are eaten at regular times each day, the stomach is trained to expect food at these times, and the movements of the stomach walls which make you feel hungry will begin.

Meals usually are well balanced. That is, they are not made up of just one kind of food but of several different

kinds. A variety of food supplies your body with all the different food substances it needs. When you eat between meals, you usually eat just one kind of food, such as candy or cookies or crackers or cake. By eating this one kind of food you satisfy your hunger; and when mealtime comes, you may not be able to eat the many different foods you must have to build a healthy body. This is one reason why eating between meals is not a good health habit.

The best way to keep from getting hungry between meals is to eat enough food at breakfast and lunch and dinner to keep your stomach busy between meals. When your stomach is busy digesting food, you are not likely to feel hungry. Some boys and girls who should gain weight or strength may need something to eat after school. The best foods for this extra meal are milk and fruit. Fruits such as apples, peaches, and pears, when eaten with the skins on, should always be washed before eating.

EATING

Allow enough time for each meal so that you can take small mouthfuls of food and chew each mouthful thoroughly. It is not necessary to say to yourself each time you take a bite, "Now I must remember to chew this food well before I swallow it." If you have been in the habit of gulping down your food in a hurry you may need to put your mind on the business of chewing your food for a few meals. But you will find that thorough chewing is a habit that is quickly learned. Then you can occupy your mind with pleasant thoughts as you eat, or engage in cheerful talk between bites.

Drink all the water you like with your meals, but do

"A jester of the sixteenth century. Laughter and good cheer at the table have been prized in every period of history

not use it to wash down half-chewed food. Water is very helpful in digestion, but it cannot actually digest food. It dissolves sugar, for example, but it cannot change starch into sugar. It helps to soften foods, but it cannot change them into the simple substances which the cells can use. Only the digestive juices can do that. Drink water only when there is no food in the mouth. Drink cool water rather than ice water. A temperature of 100 degrees Fahrenheit in the stomach is necessary for digestion. As iced drinks lower this temperature, they delay digestion.

Table Manners

Our table manners are based on health rules as well as on what people consider to be good taste. We scrub our hands with soap and warm water before eating not only to show people that our hands are clean but also because well-washed hands are less likely to carry harmful germs than unwashed hands. We wash dishes, glasses, and silver in hot soapy water, rinse them with boiling water, and dry them on a clean towel not only to make them look clean and sparkling on the table but also to rid them of any harmful germs which they may have picked up from the mouths and hands of the people who last used them.

Good table manners make meals more pleasant. They aid digestion. Eating with the mouth closed, drinking soup noiselessly from the side of the spoon, wiping the mouth with a napkin after drinking milk or eating bread and butter, taking small bites, making as little clatter as possible with knives and forks, taking care not to spill food or drop crumbs on the floor, asking to have things passed instead of reaching for them, and not forgetting to say "please" and "thank you" are ways in which we may make eating pleasant.

"At the very first Thanksgiving feast everyone was hungry and happy. Why

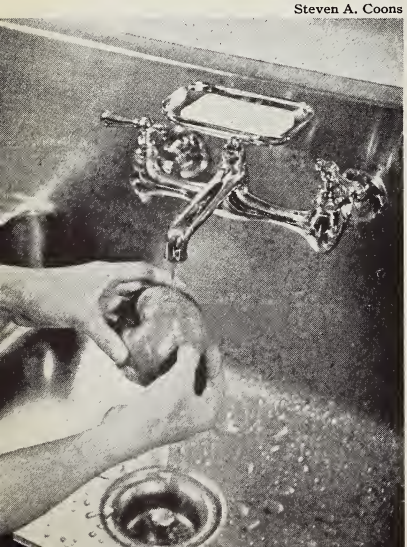
AFTER THE MEAL

According to the size of the meal, it usually takes you from about twenty minutes to an hour to chew and swallow the food a little at a time. This whole load of food is received by the stomach, which must hold it until by slow degrees the food is made ready to pass into the small intestine. During the first half hour or so after a meal large amounts of gastric juice are needed by the stomach. This juice is manufactured from materials supplied to the stomach by the blood. The stomach muscles are also especially active when the stomach is full of food. They need extra supplies of oxygen and food materials which furnish heat and energy. The blood is the carrier of these supplies. Active exercise after a meal increases the amount of blood in the muscles of your arms and legs and lessens the supply going to the stomach. Digestion in the stomach is thus delayed. This is why you should not play or work hard for at least half an hour after a meal.

"

The thing to do before eating fruit. Do you know why?

Steven A. Coons



Think of all the things that do not make your muscles work hard, such as reading, playing certain games, working at a hobby, talking with your friends, listening to the radio, taking a leisurely walk. You can have fun and yet give your stomach a good start on the work it has to do.

"

This girl has learned to set a table properly

Steven A. Coons

ARE YOU DOING YOUR BEST TO AID DIGESTION?

Do you keep from eating many fried foods?

Do you have a regular time each day for a bowel movement?

Do you eat raw vegetables and fruits and drink at least six glasses of water a day?

Do you rest before a meal when you are hot and tired from work or play?

Are you cheerful at mealtime, and do you do what you can to make the meal pleasant for everyone?

Do you keep from eating between meals so that you are hungry at mealtimes?

Do you wash your hands with soap and water and brush your hair before meals?

Do you eat slowly and chew each mouthful of food thoroughly?

Do you have good table manners?

Do you keep from exercising hard for half an hour after meals?

1. Match each group of words in the list below the box with the word or words in the box that you connect with it. (*Do not write in the book.*)

large intestine	gastric juice	saliva
villi	esophagus	liver

digestive juice in the mouth which changes starch to sugar
digestive juice in the stomach which acts on proteins
the main storehouse of sugar in the body
part of the digestive tract in which waste materials collect
food pipe down which food passes from the throat to the stomach
tissues in the lining of the small intestine

2. Some of the following statements are true and some are false. Reword each false statement so as to make it true. (*Do not write in the book.*)

a. All completely digested food is used immediately by the body cells.

b. Taking medicine is a good way to cause a daily bowel movement.

c. The flow of saliva and gastric juice at mealtime is hindered by worry, anger, or tiredness.

d. When bread is not chewed thoroughly, the gastric juice will finish the job of changing into sugar the starch it contains.

e. By eating meals at a regular time each day, you can train your stomach to make you feel hungry for meals.

f. Eating between meals is a good health habit because it supplies the body with extra food.

g. Drinking ice water may delay digestion.

h. It is not necessary to wash the hands with soap and water before eating unless they look dirty.

i. Baseball is a good game to play right after lunch.

THINK ABOUT THESE QUESTIONS

1. In digesting a lean-meat sandwich, which of the following foods will be acted on first: the meat, the bread, or the butter? Which will be acted on second? which third? In what part of the digestive tract will the digestion of each of the three begin?

2. Why is it that the food you eat must be changed in the digestive tract before it can be used by your body? What are some of the changes that take place?

3. Why is it that a person may have indigestion if he eats when he is very tired or cross or worried? What are some of the ways in which you can make mealtime a happy, pleasant time for yourself and your family?

DO THESE THINGS

1. Place a spoonful of sugar in one glass of water and a piece of hard candy in another glass of water. Which dissolves faster? Use this experiment to explain why food which is ground into fine bits by the teeth digests more easily than food which is swallowed in hunks.

2. Dip a lump of sugar in a cup of melted lard. Let the lard harden and place the lump of sugar in a glass of water. Place in another glass of water a lump of sugar that has not been coated with lard. What happens? Can the water get at the sugar through the lard coating? Explain why it is that fried foods are harder to digest than foods that are boiled or cooked in the oven.

3. Ask your butcher for a piece of sausage skin. This skin is similar to the thin skin, or membrane, which lines your small intestine. Fill the skin with sugar dissolved in water and place it in a bowl of water. After a half hour taste the water in the bowl. How does it taste? Does

this experiment make clear to you the manner in which simple food substances pass from the small intestine into the blood stream?

4. Plan the invitations, amusements, refreshments, and place cards for a party for any one of the following occasions: your mother's birthday, Halloween, a little child's birthday party, Christmas Eve, New Year's afternoon, the Fourth of July, Queen Victoria's birthday, Saint Valentine's Day, Saint Patrick's Day. What must you do at the party to see that everyone has a good time? Can you think of ways to guard against the digestive upsets that sometimes happen to some of the guests after a party?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

digestive tract	esophagus	network
fluid	gastric juice	fiber
lymph	valve	large intestine
digestive juice	small intestine	roughage
saliva	coil	Fahrenheit
salivary glands	villi	membrane

2. Tell what you think of in connection with each of the following words or terms:

digestive tract	network	Fahrenheit
digestive juice	fiber	membrane
valve	roughage	salivary glands

UNIT IV

Good Teeth

According to an old fable there was a time when the parts of the body did not work well together. The hands and the mouth and the teeth were always complaining about the stomach.

They said, "It lives an idle useless life, while we must work for its support and take care of all its wants and pleasures."

At last the hands and the mouth and the teeth agreed to cut off the supplies of the stomach.

"We will no longer carry food to the mouth," said the hands.

"If the hands do not carry out this good resolution, I will not receive the food," said the mouth.

"If the hands and the mouth both forget their share of the agreement, we will not chew the food," said the teeth.

This strike had not lasted very long before all the parts of the body began one by one to grow weak and sick. The hands and the mouth and the teeth had discovered that the stomach, useless as it seemed to them, has an important duty of its own. They had learned that they could no more do without it than it could do without them. From that time on, so the story goes, all the parts of the body have worked together, each in its proper place, for the good of all.

It is said that this fable was first told about two thousand five hundred years ago by the fable-maker Aesop. Since then it has been used many times to persuade people to work together for a purpose shared by all.

We know that teeth cannot talk. And yet the teeth help us to form words clearly in talking. Have you noticed that young children who have lost their front baby teeth sometimes talk with a lisp? Old people who have lost most of their teeth often mumble their words. The teeth also help to give form to the face. The cheeks sink in and the chin looks as if it were trying to touch the nose when a person has lost most of his teeth.

Chewing is the first thing that happens to the food you put in your mouth. The teeth cannot refuse to chew the food, but it may be impossible for them to chew food well. If many teeth are missing or if the teeth are crooked or decayed, they may not be able to do their work thoroughly. Then the stomach will have to work overtime to break up lumps of food which should have been ground into small bits by the teeth.

Teeth are made of materials in the food which they chew. In chewing they work for themselves as well as for all the other parts of the body. The food you eat and the care you give your teeth make a great difference in the ability of the teeth to do their share of the work of the body. A set of strong healthy teeth, each one in its proper place, will be able to do a good job of chewing the food upon which you depend for growth, good health, and the energy to work and play.

DO YOU KNOW

Why you have teeth?

Why you have two sets of teeth?

Why you have teeth of four different shapes?

What great discovery was made by Wilhelm Konrad Roentgen?

Why you should brush your teeth?

What kind of toothbrush is best?

Why the dentist is sometimes called "the children's friend?"

Which of the foods in the picture supply materials for building good teeth?

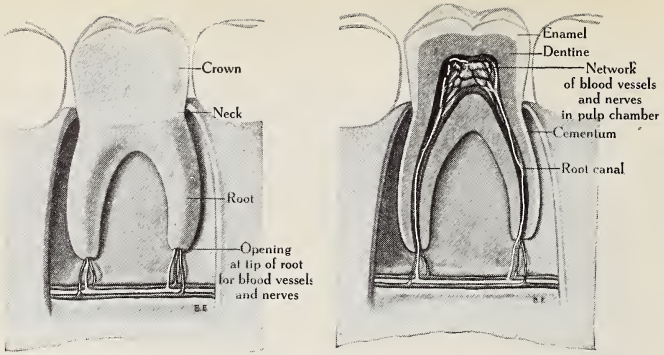
Look at your teeth in a mirror. You can see only part of each tooth. The part you see is called the crown. It is covered with a substance called enamel. This white substance is the hardest material in the body. Even so, it can be broken if you use your teeth to bite very hard candy or to crack nuts.

The part of the tooth which you cannot see is the root. It holds the tooth in the jaw, just as the roots of a plant hold the plant in the ground. Some teeth have one root, some have two, and some have three. The place at the gum line, where the root and crown meet, is called the neck of the tooth. The roots of the teeth have a thin outside coating of a bonelike material called cementum. A little opening at the tip of each root lets blood vessels and nerves enter the tooth. The blood in the blood vessels brings food for the tooth and carries away its wastes. The nerves give the teeth their ability to feel. Have you ever had a toothache? A toothache means that the nerves of a tooth are sending messages of pain to the brain. Only living things can feel. One way of knowing that a tooth is alive is its ability to feel pain.

The body of the tooth is the part which lies under the outer coatings of enamel and cementum. It is made of a thick white substance called dentine, which is softer than enamel and cementum.

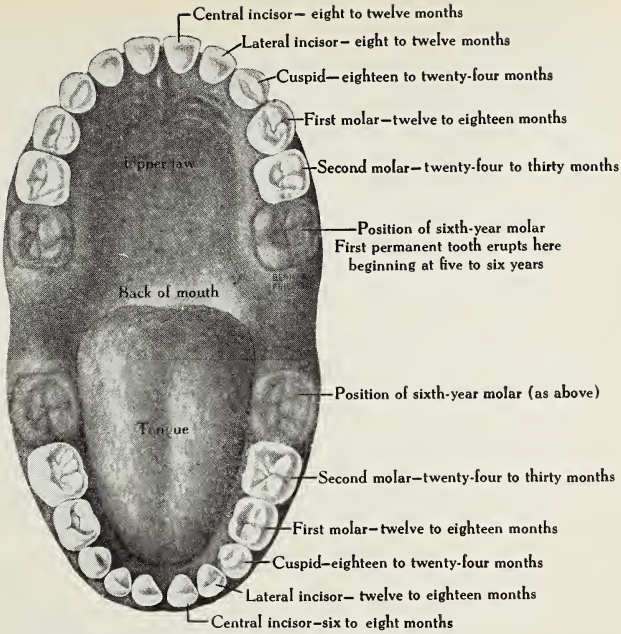
How Teeth Grow

When a baby is born, all his first teeth are partly formed. His permanent teeth are also beginning to develop under the first teeth. The peculiar thing about the way in which teeth grow is that they grow from the top down. The



The diagram on the left shows the three parts of a tooth.
The diagram on the right is of a tooth cut in half lengthwise, to show the materials of which it is composed

crown of the tooth is formed first. Each tooth grows in a little sac, or bag, in the jawbone. There are twenty sacs for the baby teeth, and thirty-two sacs for the permanent teeth. The sacs are filled with a jelly-like substance composed of tooth cells, nerves, and blood vessels. From the blood the cells take the materials which are needed for building teeth. These materials are calcium (a substance which is in lime) and phosphorus. The cells mix these minerals and then deposit them in layers to build up the crown at the top of the sac. As the crown grows larger and the roots extend downward, the sac becomes smaller, shrinking to a very small amount of soft material, the pulp, enclosed in the center of the tooth. The space in the center of the tooth is called the pulp chamber. The pulp is all that is left of the tooth cells, blood vessels, and nerves with which the tooth started out in life. The way out for the blood vessels and nerves in the pulp chamber is a little tunnel, called the root canal, which runs down through each root.


Central incisor— eight to twelve months
Lateral incisor— eight to twelve months
Cuspid—eighteen to twenty-four months
First molar—twelve to eighteen months
Upper jaw
Second molar—twenty-four to thirty months
Position of sixth-year molar
First permanent tooth erupts here
beginning at five to six years
Back of mouth
Position of sixth-year molar (as above)
Tongue
Second molar—twenty-four to thirty months
First molar—twelve to eighteen months
Cuspid—eighteen to twenty-four months
Lateral incisor— twelve to eighteen months
Central incisor—six to eight months

The first, or baby, teeth and the usual ages at which they erupt

The Baby Teeth

The small jaw of a little child is not big enough to hold the teeth which he will need when he is older. And yet he must have teeth to chew solid food when he begins to eat things besides milk, fruit juices, and other liquid foods. For this reason nature provides him with a set of first teeth, or baby teeth, to use until his jaw is big enough to hold the larger, stronger teeth which he will need for the rest of his life.

Roberts

"Are my teeth clean?"
The dentist is one of the best friends a small child can make

There are twenty teeth in the first, or baby, set, ten on the lower jaw and ten on the upper. The first teeth to come in are usually the two front teeth on the lower jaw. They appear when the baby is from six to eight months old. By the time a child is two and a half years old, he usually has all his first teeth. The different kinds of baby teeth and the ages when they come in, or erupt, are shown on page 77.

Some people do not think that the first teeth are important. Such persons are very careful of a child's eyes, ears, arms, and legs, because they know the child will never get any others. But they say: "What does it matter if a first tooth does decay and is pulled out before the right time comes for it to fall out? The child will get another tooth later to take the place of the first one." People who think this way are not careless about dishes, because they know they can buy new ones. They buy the dishes to *use*, and they take good care of them. A child's first teeth are given him to *use*. If he loses them before his second teeth begin to come in, he cannot chew his food properly. Besides, under each first tooth a second tooth is forming. If the first tooth is lost too soon, the teeth on each side of it close in to fill the gap. Then the second tooth beneath it will not have room to come through the gums into its proper place. The baby teeth may be called pathfinders for the permanent teeth. They guide the permanent teeth into their proper places.

The baby teeth need the same good care that the permanent teeth require. A child should be taken to the dentist before he is two years old and as often afterward as the dentist thinks necessary. He should also learn how to clean his teeth properly as soon as he is old enough to brush his teeth by himself. Have you any little brothers and sisters? Or are you friendly with any little children in your neighborhood? After you have finished working on this unit,

perhaps you can teach them to brush their teeth properly and to do other things which will help to keep their teeth healthy.

The Permanent Teeth

Look at your teeth in a mirror again. Now feel them with your tongue. The teeth in the front part of the jaws look different and feel different from the teeth in the back part. You have teeth of four different shapes, because four different kinds of work must be done by the teeth.

The front teeth have thin biting edges in order to cut food, much as a pair of scissors cuts cloth. These teeth are called incisors. This name comes from a Latin word which means "to cut." By the time you were eight years old, you probably had all eight of your permanent incisors. They are the four front teeth on your upper and lower jaws. Locate your incisors by looking in the mirror.

Next to your incisors at the "four corners" of your mouth are four permanent teeth which are called the cuspids. They come in when a boy or girl is from eleven to thirteen years old. Do you already have your cuspids? Look and see. Perhaps they are just growing in now. The cuspids have one point, or cusp. Their job is to hold food as you chew it with the back teeth. The cuspids also tear food apart.

Next to the cuspids are the bicuspids. *Bi* means "two." The bicuspids have two points, or cusps. In all there are eight bicuspids in a full set of permanent teeth, two on each side of the upper and lower jaws. The bicuspids break and crush food much as a nutcracker cracks a nut. They usually come in when a boy or girl is from nine to eleven years old. See if you can find your bicuspids. Do you have them all or are they just beginning to appear?

How the permanent teeth form under the first teeth. Why is it important to keep each first tooth until the permanent tooth under it is nearly ready to come through the gum?

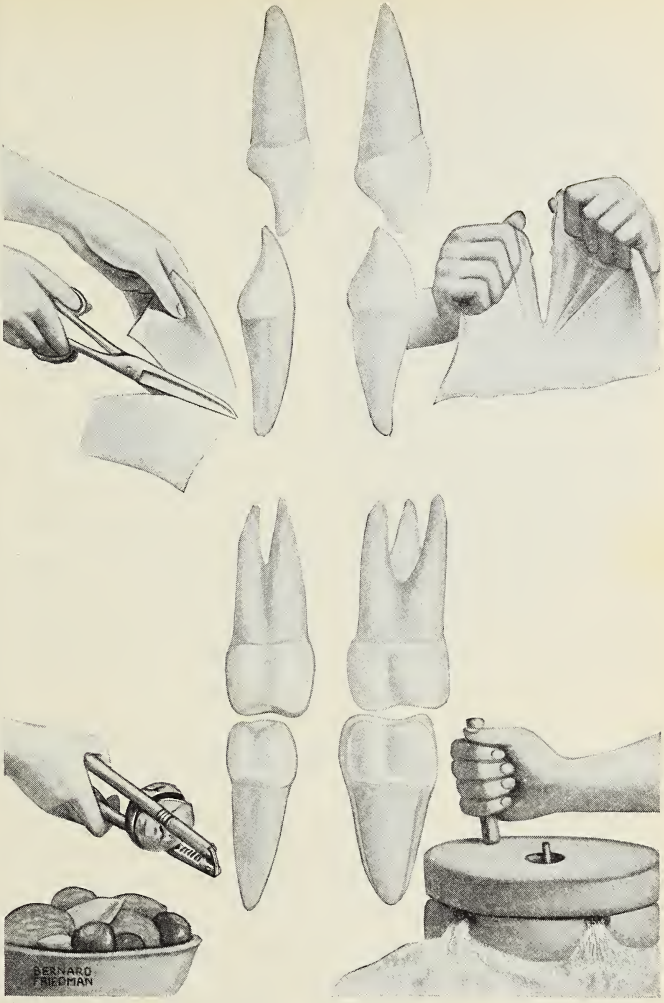
Back of the bicuspids in the full set of permanent teeth are the grinding teeth. These teeth are called molars. The word "molar" comes from a Latin word meaning "millstone." The molars grind food much as millstones grind grain. By the time you are twenty-one years old, you will probably have twelve molars, three on each side of the upper and lower jaws.

The Sixth-Year Molars

The first four molars arrived in your jaws when you were only six years old. They came in just behind the last baby molars. They are the largest and most important teeth in the lifetime set. They do the heavy work of chewing while the baby molars are falling out and the second ones are coming in. If a child loses one of his last baby molars too soon, the sixth-year molar which should come in just behind it crowds forward into the empty space. The jaw also becomes smaller to help close up the gap.

If people are sitting in a row in a trolley car or bus and all the seats are taken, a latecomer must squeeze into a very narrow space if he wishes to sit down, or he must stand in the aisle. When the place in the jaw that should be occupied by one tooth is occupied by another tooth, the latecomer to which the place rightfully belongs must squeeze into a space too small for it, or it must stand out of line either in front of or behind the other teeth. Losing baby molars too soon is one of the commonest causes of crooked teeth. Since the sixth-year molars come in when the child has most of his baby teeth, these important grinders are sometimes mistaken for baby teeth. If the baby teeth are neglected, the sixth-year molars are neglected too.

Can you find your sixth-year molars? The middle of your jaw is in line with your nose. Beginning with the first tooth to the right or left of this line, count back until you reach the sixth tooth. Count gaps as well as teeth, if any of the first five teeth are missing. The sixth tooth in line is one of the four sixth-year molars. Do you have all your sixth-year molars? Have you had to have any of them filled by the dentist? The dentist watches the sixth-year molars carefully when children are brought to him while these teeth are coming in.



Can you locate an example of each of the four
different kinds of teeth in your set of teeth?

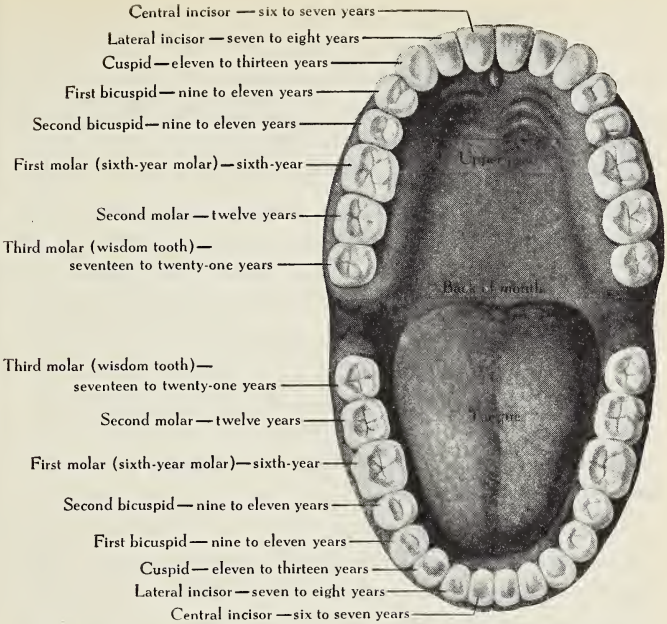
If a sixth-year molar is lost, the teeth on each side of it tip over to fill the gap. This throws the rest of the teeth out of their proper positions. As a result the upper and lower teeth do not meet as they should, and it is hard to chew food properly. Also, the upper jaw may stick out over the lower jaw. This changes the expression of the face.

The second permanent molars which come in behind the first, or sixth-year, molars arrive in the jaw when a boy or girl is twelve years old. Are your second molars coming in now? They are the seventh teeth in line counting back from the middle line of the jaw.

The last permanent teeth to erupt, or come through the gums, are the third molars, or wisdom teeth. They will not begin to appear until you are between seventeen and twenty-one years old. Have you any older brothers or sisters who are now cutting their wisdom teeth? Sometimes the wisdom teeth do not come in properly and need special treatment by a dentist. As they are far back in the mouth, they are hard to keep clean. If you learn now to brush your back teeth properly, you will not have any trouble in keeping the wisdom teeth clean when they start to come in.

HOW THE TEETH ARE FED

Blood with its load of food for the teeth enters each tooth in the tiny blood vessels which run up from the tip of each root to the pulp chamber. Blood vessels are also present in a cushion of tissue that lines the bony sockets, or hollows, out of which the teeth grow. This lining, which connects with the gums, holds the teeth in their sockets. The blood in the blood vessels which the lining contains carries nourishment to the outside surface of the roots of the teeth and the sockets in which they lie.


Central incisor — six to seven years
Lateral incisor — seven to eight years
Cuspid — eleven to thirteen years
First bicuspid — nine to eleven years
Second bicuspid — nine to eleven years
First molar (sixth-year molar) — sixth-year
Second molar — twelve years
Third molar (wisdom tooth) — seventeen to twenty-one years
Third molar (wisdom tooth) — seventeen to twenty-one years
Second molar — twelve years
First molar (sixth-year molar) — sixth-year
Second bicuspid — nine to eleven years
First bicuspid — nine to eleven years
Cuspid — eleven to thirteen years
Lateral incisor — seven to eight years
Central incisor — six to seven years

The permanent teeth and the usual ages at which they erupt

Tooth-building Materials

You have learned that the chief tooth-building materials are calcium and phosphorus. The teeth must also have other raw materials from the food you eat. These raw materials are vitamins A, C, and D. Vitamin C helps to make the gums firm and pink. A lack of this vitamin causes sore bleeding gums and the loosening of the teeth in their bony sockets. Vitamin A helps to protect the teeth and gums from infection. Vitamin D makes it possible for the teeth to use calcium and phosphorus. You might have all

the necessary building materials for a house, but you could not build it if you could not saw the wood or hammer in the nails or cement the bricks together. Vitamin D gives the tooth cells the ability to mix calcium and phosphorus together and deposit the resulting material in layers to build the teeth.

As the permanent teeth start to grow in the jaws at birth and keep on growing for at least twenty-one years afterward, you can see how important it is for growing boys and girls to eat the foods that contain tooth-building materials. In order to get enough calcium, phosphorus, and vitamin A you must have at least one quart of milk a day. To get enough vitamin C you must have tomatoes or a citrus fruit (such as an orange or lemon juice or a grapefruit) every day. Green vegetables, fruits, cheese, butter, eggs, fish or meat, and whole-grain bread and cereals supply you with part of the calcium, phosphorus, and vitamins A and C that you need for tooth-building. But it would be difficult for you to get enough of these materials without having also one quart of milk a day and either citrus fruits or tomatoes.

The rays of the sun which help the body to manufacture vitamin D, when they fall directly on the bare skin, are called ultraviolet rays. They do not go through clothing or ordinary window glass. Ultraviolet rays are strongest in the summertime. While you are playing outdoors in the summer sunlight, your body is busy making vitamin D.

During the late fall, winter, and early spring you must get from food the amount of vitamin D you need. There are not many ordinary foods which contain this vitamin. Egg yolk, butter, milk, salmon, and sardines contain a certain amount, but not enough to help the tooth cells to build strong teeth. The richest food source of vitamin D is fish-liver oil. It also contains a good supply of vitamin A.

Cod-liver oil is probably the fish-liver oil with which you are most familiar. It comes either in liquid form or in pills. Most doctors want parents to give their children cod-liver oil in the wintertime so that the children can develop strong teeth and bones. The amount of vitamin D in ordinary milk can be increased by adding cod-liver oil to the milk, or by letting ultraviolet rays shine on the milk from a special kind of lamp, or by feeding cows with cod-liver oil. Your doctor may want you to have vitamin-D milk, instead of cod-liver oil, during the seasons when the ultraviolet rays of the sun are not strong enough to help you to make this vitamin for yourself.

It is also important to eat some hard, coarse foods every day, because vigorous chewing helps to develop the jaws and to keep the gums healthy. The crusts of bread and toast, some of the ready-to-eat whole-grain cereals, apples and other raw fruit, and crisp raw vegetables, such as cabbage, carrots, and celery, are good foods for exercising the jaw muscles. In chewing these foods the muscles work hard.

Have you ever heard it said of a person who is very fond of candy, "He has a sweet tooth"? Eating too much candy or cake may spoil your appetite for foods that contain vitamins and minerals needed for tooth-building. This is one reason why a person who has a "sweet tooth" may have bad teeth. It is best to eat sweet foods only for dessert.

Roberts

Chewing an apple is good exercise for the jaw muscles

HOW THE DENTIST HELPS TO PROTECT YOUR TEETH

Millions of germs are present even in a clean, healthy mouth. In an unclean mouth this number is much larger. Most of these germs are harmless, but some kinds form acids by acting upon bits of food held in the spaces between the teeth and in the wrinkles on the biting surfaces. If these acids are allowed to form, they may eat through the hard white enamel covering of the teeth. Although a hole in the enamel may be no bigger than a pin point, the acid-forming germs can enter through it and start decay in the softer dentine underneath.

When growing teeth do not get enough calcium and phosphorus or enough vitamin D, a new tooth just through the gums may have little pits or cracks in the enamel. These pits or cracks may catch and hold the bits of food which furnish the feeding places for acid-forming germs. If you go to the dentist as often as he thinks necessary, he will discover any cracks in a new tooth as soon as it comes in and will fill them. Usually it does not hurt to have this done, as there are no nerves in the enamel of a tooth. If the dentist finds that a hole has already been eaten through the enamel and that decay is beginning to spread in the dentine, he cleans out the decayed place much as you cut out a bad spot from an apple. When the decayed place has been cleaned out, the dentist fills it with a hard substance to take the place of the dentine and the enamel which have been eaten away.

What happens if you do not go to the dentist regularly? Without your knowledge you may have tiny holes in the enamel of one or more teeth through which acid-forming germs may enter. Remember that the nerves which cause pain are enclosed in thick walls of dentine. They cannot

tell you that decay has started. It is not until the decay has eaten through the dentine to a spot close to the little pulp chamber in the center of the tooth that your tooth starts to ache. When people have toothache, they usually go to the dentist. Even then the dentist may save the tooth. The fact that it aches shows that the nerve is still alive. But if a person with a toothache puts a drug on the tooth to kill the pain or takes a pain-killing medicine, he may find after a while that the tooth has stopped aching. This means that the acid-forming germs have reached the pulp chamber and killed the nerve. Then the owner of the tooth may not pay any more attention to it, even though there may be a jagged hole in the crown which cuts his tongue. He does not know what is going on inside his tooth.

In the pulp chamber, where the blood vessels and nerves are located, the harmful germs are still at work. White cells in the blood, called white corpuscles, fight the germs by eating up as many as possible. In this fight many white corpuscles are killed. The white corpuscles and the germs which have died fighting each other form a thick yellowish substance called pus. You may have seen pus in an infected cut or pimple. Sometimes the pus travels down the root canal of the tooth and forms a little bag of pus, called an abscess, at the end of the root. The abscess may push through the jawbone and gum to form a boil or a large and painful swelling of the face. The chances are that the tooth which was meant to last a lifetime will now have to be pulled out.

Hidden Centers of Infection

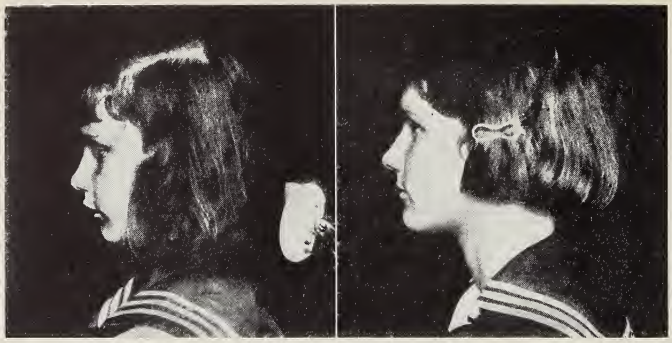
Sometimes an abscess forms at the roots of a tooth without causing pain or swelling. The tooth may look and feel perfectly sound. But the blood, in its travels from the heart

and back to it, visits all the different parts of the body, and if there is a center of infection anywhere in the body, the blood may carry the poisons from this infected spot to some other part of the body. A center of infection is sometimes called a focal infection. Abscesses at the roots of the teeth and diseased tonsils are two common focal infections. A person who has such a focal infection may not know anything about it. And yet poisons from a hidden abscess at the root of a tooth or from diseased tonsils may cause heart trouble or aches in the joints or disturbances in other places far distant from the center of infection. An important reason for regular visits to the dentist and for a physical examination once a year by a physician is to make sure that your teeth and your tonsils are healthy.

The dentist finds out whether or not you have a hidden abscess at the root of a tooth by taking an X-ray picture of the roots. X rays are rays which cannot be seen by the human eye. They go through substances that ordinary light cannot enter. You know that you cannot take a picture with a camera without light. Before X rays were discovered by Wilhelm Konrad Roentgen about forty-three years ago, no one dreamed that it would be possible to take pictures of the inside of the body. But now X rays are used to light up the inside of the body so that pictures can be taken of any part.

The dentist also uses X rays to find out how far decay has spread in a decayed tooth. Have you ever had an X-ray picture taken of your teeth? The object the dentist puts in your mouth is the camera film. The X rays furnish the light, and the camera in the X-ray machine takes the picture. It does not hurt to have an X-ray picture taken any more than to have a picture taken by an ordinary camera.

An X-ray picture of a tooth may bring to light decay which cannot be seen by looking the tooth from the outs



Two pictures of the same girl, one taken before and the other after a dentist had straightened her teeth. Is her face prettier in one picture than in the other? Why?[1]

Crooked Teeth

You have learned that crooked teeth may be caused by losing baby teeth too soon or by losing a sixth-year molar before or during the time that the other permanent teeth are coming in. Sometimes a child's jawbones are so narrow that there is not enough room for the teeth to come in straight. A child may have narrow jaws if he does not get enough vitamin D for bone-building.

Another cause of narrow jaws is thumb-sucking. Do you know any little children who suck their thumbs? Can you think of any ways in which you can help the children to break this habit? Thumb-sucking narrows the jaws so that the upper teeth are forced out and the lower teeth are forced in. Breathing through the mouth instead of through the nose may hinder the proper development of mouth and

[1] Case treated by Jesse A. Linn. Photographs from "These Teeth of Mine," by D. W. McLean, published in *Hygeia*.

jaw. If you find trouble in breathing through the nose, tell the doctor at your next health examination.

Crooked teeth may give the face an unpleasant appearance. They make proper chewing difficult and are hard to keep clean. If children start going to the dentist at an early age, the dentist will be quick to note the first signs of crooked teeth and will begin to straighten these teeth when they are easy to move into their proper positions.

KEEPING THE TEETH CLEAN

As germs in the mouth, acting on bits of food sticking to the teeth, form acids which eat through the enamel, keeping the teeth clean is an important weapon in the fight against tooth decay. Brushing the teeth does not destroy the germs. It simply removes their supply of food. As food collects chiefly between the teeth and in the wrinkles on the biting surfaces, it is important to loosen and sweep out these bits of food with the brush.

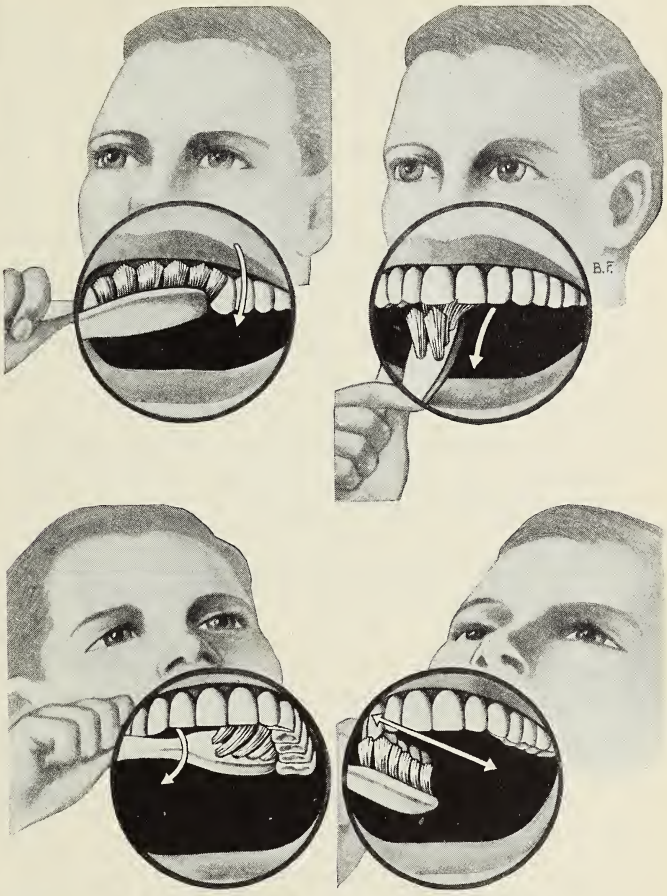
Your toothbrush should be small enough to allow free movement in the space between your teeth and gums and your cheek, and to make it possible for you to reach the last tooth in line on the upper and lower jaws. The bristles should be firm and arranged in groups with spaces between the groups. This makes it easy to wash bits of food out of the brush after cleaning the teeth. Hang your toothbrush on a hook or keep it in a glass head up and away from all other brushes. It is best to keep it in a place on which the sun shines for at least part of the day. As soon as the bristles in your brush begin to soften or fall out, throw it away and buy a new one. Some people have two brushes so that each brush will be used only every other day. This gives the bristles a chance to dry out thoroughly.

How to Brush the Teeth

In brushing the teeth do not scrub across the teeth, as this may injure the gums and the necks of the teeth. Brush them away from the gums and toward the biting and grinding surfaces. Brush them so that you can feel the bristles slide in between the teeth. Clean both the inside and outside of the teeth and the biting and grinding surfaces. Use dental floss to clean the spaces between the teeth which the bristles of the brush cannot reach. It is also important to rub the gums well either with the brush or with the fingers. When you do this, be careful not to bruise the gums. Rinse the mouth with warm water after the brushing. Brush the teeth for three minutes at least twice a day, in the morning and at night before going to bed. After each meal rinse the mouth and teeth with warm water if it is impossible to brush them.

The use of tooth paste or tooth powder, when you brush your teeth, will make your mouth and teeth feel fresh and clean. These aids to cleaning the teeth are called dentifrices. If you do not have tooth paste or tooth powder, you may use a mixture of one-third salt and two-thirds baking soda. (Whatever dentifrice you choose, remember that the most important thing in cleaning the teeth is the brushing.) A tooth paste or tooth powder must not be expected to kill germs in the mouth, or whiten the teeth, or make the gums healthy. The dentist will tell you what to do if you are bothered with sore or bleeding gums.

Sore gums may be caused by a collection of tartar at the necks of the teeth. Tartar is a hard greenish substance which makes the teeth look dirty and irritates the gums. When you go to the dentist for your regular visit, he or his helper, the dental hygienist, will remove any tartar which may have collected on your teeth.



These pictures show the positions in which the toothbrush should be held and the direction in which it should be moved while brushing the upper teeth

ARE YOU DOING YOUR BEST TO TAKE GOOD CARE OF YOUR TEETH?

Do you have at least one quart of milk and an orange, a grapefruit, lemon juice, or tomatoes every day?

Do you eat green-leaf vegetables every day?

Do you take cod-liver oil or vitamin-D milk in the seasons when the ultraviolet rays of sunlight are not strong enough to help you to make vitamin D for yourself?

Do you spend some time each sunny day in working or playing out of doors?

Do you chew your food thoroughly and each day eat some hard foods, such as toast or raw crisp vegetables, to exercise your jaws?

Do you go to the dentist every six months, or as often as he wants you to?

Do you try to help the dentist by not making a fuss when he examines your teeth or cleans them or does whatever repair work he finds necessary?

Do you brush your teeth for three minutes at least twice a day, morning and night?

Do you rinse your mouth with warm water after each meal?

Do you wash your toothbrush after use and hang it in a place where it will dry thoroughly before it is time to use it again?

1. Complete the following sentences by supplying the missing word or words. (*Do not write in the book.*)

a. We have teeth because food must be __?__.

b. There are __?__ teeth in the baby set and __?__ in the permanent set.

c. The first teeth of the permanent set to come in are the __?__ __?__.

d. The principal tooth-building materials are __?__ and __?__. We get these materials chiefly from __?__.

e. __?__ __?__ helps to protect the teeth from infection. We get this substance chiefly from __?__.

f. __?__ __?__ helps to make the gums firm and pink, and to prevent sore and bleeding gums. We get this substance chiefly from __?__ __?__s and __?__s.

g. The substance which makes it possible for the tooth cells to build teeth is __?__ __?__. The richest food source of this substance is __?__ __?__.

h. Tooth decay is caused by __?__ in the mouth which act on bits of food in the teeth to form __?__.

i. The __?__ helps to prevent tooth decay or to check it if we visit him regularly.

j. By __?__ __?__ __?__ at least twice a day we can help to prevent tooth decay.

2. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. It is not important to take care of the baby teeth, as the child will get a second set to last him through life.

b. One cause of crooked teeth is the early loss of sixth-year molars.

c. Teeth grow from the top down.

d. Eating too many sweets may cause tooth decay.

e. The best way to brush the teeth is back and forth across the teeth.

f. Crooked teeth are hard to keep clean, and they interfere with proper chewing.

g. A hidden abscess at the root of a tooth may cause trouble in other parts of the body.

h. You should keep away from the dentist because he might hurt you.

THINK ABOUT THESE QUESTIONS

1. Decay of the teeth is the commonest physical defect found among school children. Do you know of any reasons why this should be so? Explain how each one of the following things might lead to tooth decay among children: (*a*) the feeling on the part of some parents that children's first teeth are not important; (*b*) fear of the dentist caused by hearing older people talk about painful experiences in the dentist's chair; (*c*) the cost of having teeth repaired by a dentist.

2. Are there dental clinics in your community where children can have their teeth cared for at small cost? Do you know of any ways in which the parents have been told about these clinics? If your parents could not afford to have your teeth cared for by a dentist, should you consider strong healthy teeth important enough to earn the money to have them repaired? If so, what are some of your reasons for thinking that good teeth are important?

DO THESE THINGS

1. Find out about the teeth of different animals. What sort of teeth does a dog have? a tiger? a horse? a cow? an elephant? What foods are eaten by each animal studied? How are the teeth of each animal fitted to chew

"

How does a community help to protect the health of its young citizens when it supports a dental clinic where children may have their teeth cared for at small cost

the usual food of that animal? How do chickens and birds chew their food? Why is it not necessary for dogs to grind up their food?

2. Find out what you can about the teeth of groups of people living in different parts of the world. Find out about the food habits of the groups studied. Can you explain why it is that the Eskimos have strong healthy teeth although they do not clean their teeth or go to the dentist? Why is it that the Eskimos begin to have tooth decay as soon as they start to eat the food of more civilized people?

3. Make a picture of your upper and lower jaws similar to the picture on page 85, which shows a complete set of permanent teeth. Locate on the picture of your jaws the teeth you now have and label each one incisor, cuspid, bicuspid, molar, as the case may be. If you can remember when some or all of the permanent teeth you now have first came in, or erupted, put the date of eruption above each one of these teeth. How many of your permanent teeth do you have? How many are just coming in? How many have not erupted yet or have been pulled out?

4. Chew a piece of bread thoroughly. Do you notice any change in the taste after chewing it for some time? If so, how do you explain the change? In what way does thorough chewing increase the enjoyment of food?

5. Keep a record for one week of the foods you eat each day which are rich in calcium, phosphorus, and vitamins A, C, and D. Turn back to the list of foods on page 49 which gives the chief sources of the different vitamins, and refresh your memory about these foods.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

dental floss	pulp (of a tooth)	ultraviolet rays
erupt	pulp chamber	vigorous
eruption	root canal	abscess
X rays	socket	bicuspids
molars	acid	dentine
enamel (of a tooth)	tartar	cuspids
bristles	incisors	wisdom teeth
defect	dentifrice	dental hygienist
dental clinic	cementum	focal infection
crown (of a tooth)	millstones	

2. From the list above pick out the names of the four different kinds of teeth. How does each kind of tooth get its name?

3. From the list above pick out the words used in describing a tooth.

4. Choose a word from the list above to complete each one of the following sentences:

a. Grain is ground between two __?__.

b. The last permanent teeth to __?__ through the gums are the __?__ __?__.

c. The __?__ __?__ of the sun shining on the bare skin make it possible for the body to manufacture vitamin D.

d. The dentist told Mary the name of a good __?__ to use on her toothbrush when she cleans her teeth.

e. When the __?__ of Tom's toothbrush become soft, he throws the toothbrush away and buys a new one.

f. Miriam uses __?__ __?__ to remove bits of food caught between her teeth.

g. Robert's mother took him to the __?__ __?__ to have the __?__ in his teeth corrected.

h. The dentist asked his helper, who is a __?__ __?__, to clean the __?__ from David's teeth.

UNIT V

How Food and Oxygen Are Carried in the Body

When you feel very hungry, you can look for something to eat. When you feel the need of fresh air, you can open a window or run outdoors to play. But almost all the cells in the body are fixed in one place. They cannot wander about in search of food and fresh supplies of oxygen. Everything they need must be carried to them.

Running water is one way by means of which things may be carried from one place to another. Probably you have watched leaves and sticks carried along in the current of a brook. Logs are floated from the forest, where they were cut, to sawmills far down the river. Rich soil from the hills is carried down to the valleys in the spring flood waters of streams.

Food and oxygen are carried to the body cells in a swiftly flowing stream. This stream is called the blood stream. However, blood is not simply water colored red which runs through the body in order to carry things from one place to another. Your health and even your life depend on the fluid which you may have heard spoken of as "life blood." This fluid is a mixture of many different substances which are supplied by the food you eat. The heart, which pumps the blood round and round through the body, is a muscle. It is built up of materials supplied by food, and it gets the energy to beat from food. What you eat makes a great difference in the ability of the heart and the blood to do their work properly.

DO YOU KNOW

The name of the liquid in which the body cells live?

The place in the body where food passes into the blood stream?

Which blood vessels have the thinnest walls?

The principal food substance stored in the body for future use?

Why the doctor places his finger on your wrist and looks at his watch when you are ill?

The difference between an artery and a vein?

Where your heart is located?

What part of your weight is blood?

What foods you must eat to have red blood?

What common substances contain drugs that make the heart beat faster?

Who William Harvey was and what he discovered about the motions of the heart and blood?

George French

Compare this method of transporting logs from the forest to the sawmill with the method by which supplies are carried from one place to another in the body

HOW BLOOD HELPS TO NOURISH THE BODY

All the cells in the body live in a watery liquid. From this liquid the cells take what they need, and into it they empty their wastes. The watery liquid in which the cells live is called lymph. Lymph is a fluid which has soaked through the thin walls of the tiniest blood vessels into the spaces between the cells.

If you dig up a sod of grass with a trowel and pack it into a glass so that the earth reaches to the very bottom

of the glass, you will find that you can also pour water into the glass although the earth and grass roots seem to fill it completely. Surrounding the roots and each grain of earth there are tiny spaces that the water occupies. Lymph surrounds the cells as water surrounds the grains of earth. Tiny blood vessels winding everywhere among the cells may be compared to the roots of the grass.

These blood vessels are the capillaries. You can see separate grains of sand and the fine roots of grass, but in a piece of flesh you cannot see the single cells of which it is made or the tiny hairlike capillaries that wind among the cells. In order to see the lacy pattern of flesh you would need a microscope.

Objects which have been placed under a microscope appear to be many times larger than they really are. If your school has a microscope, perhaps your teacher can arrange to have you look through it at a thin slice of raw meat or at a drop of blood or at the veins in a leaf. The microscope was invented near the end of the sixteenth century. It at once opened up to people a strange new world, the world of the things which the human eye alone cannot see.

The capillaries, which wind everywhere among the cells of the body as roots of grass wind in and out among grains of earth, are very fine branches of the great system of blood vessels which runs through the length and width of the body. The

© Screen Traveler, from Gendreau

A network of capillaries is hundreds of times smaller than the finest cobweb

walls of the larger blood vessels are too thick to allow liquid food to pass through them. The only purpose of the larger blood vessels is to provide a way for the blood to go from the station where it takes on a load of completely digested food or a load of oxygen to the stations where food and oxygen can pass from the blood into the lymph which bathes the cells. These stations are the networks of capillaries which have walls thin enough for oxygen and liquid food to pass through them.

The only station where food passes into the blood stream is the network of capillaries in the villi of the small intestine. The only station where oxygen passes into the blood stream is the network of capillaries in the lungs. But there is not a single place in the whole body which does not have a station for the delivery of food and oxygen. All the living tissues in the body are supplied with networks of thin-walled capillaries which act as little stations for the delivery of food and oxygen to the cells.

THE MATERIALS IN BLOOD

The water in a swiftly flowing muddy brook looks as if it were all liquid. But if you scoop up some of the water in a glass and allow it to stand for a while, you will notice that the dirt in the water slowly sinks to the bottom of the glass. The water freed of the dirt looks clear. Instead of speaking of the muddy water as pure liquid we say that it contains both liquid and solid substances.

Blood also is partly liquid and partly solid. If you have ever watched what happened when you cut your finger, you have already learned that blood contains solid substances. In about five minutes the blood began to thicken over the cut. This thickening of the blood is called clotting.

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Why is the water in which vegetables have been boiled too valuable to be thrown away?
(See page 110)

KODACHROME BY STEVEN A. COONS

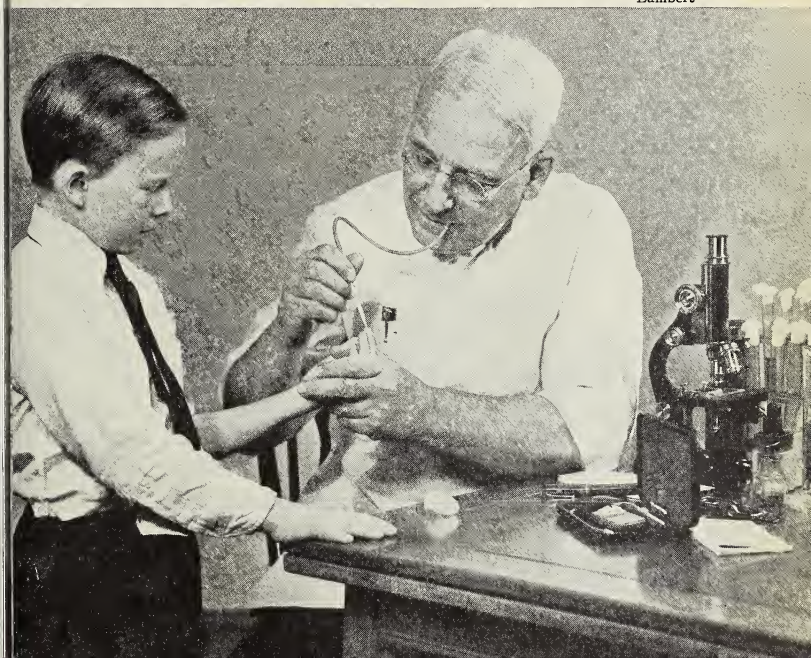
'''

If your blood could not clot and plug up a break in the skin, you might bleed to death from a small cut.

Because blood forms a clot when it rests on the skin instead of separating into its solid and liquid parts, you cannot see what blood looks like when the two parts are separated. But a scientist in examining blood can keep it from clotting by placing it on ice. When this is done, the blood separates into two layers. The lower layer is a reddish purple and the upper layer a clear yellow. If you fill a glass half full with small dark red beads and the other half with lemonade, you will have some idea of what the

Taking a sample of blood for a blood test.
One of the things a doctor finds out in making this test is whether a person has enough red and white corpuscles in his blood stream

Lambert



scientist sees when the blood separates into its solid and liquid parts. The solid part of the blood is made up of cells called corpuscles. The corpuscles are of two kinds, red and white. They are the only cells in the body that are not fixed in one place.

The red corpuscles are the oxygen-carriers of the blood. In the lungs they take on a load of oxygen to carry around to the body cells. From the body cells they take the waste gas, carbon dioxide, which they carry to the lungs to be removed from the body.

Red corpuscles are round and flat and extremely small. They cannot be seen by the human eye. When you look at blood, you see only a red liquid. You do not see the corpuscles which give the blood its red color.

As small as the corpuscles are, they must pass through the capillaries in single file. Often a corpuscle is larger than the capillary through which it must pass. It has to be squeezed to allow it to pass through. This will give you some idea of the fineness of the capillaries.

The white corpuscles are larger than the red ones. There is about one white corpuscle for every seven hundred red cells in the blood. The white corpuscles can move by themselves. The red corpuscles cannot move. They are like the loose grains of sand that are carried along in a swiftly flowing stream. The white cells can wander through the walls of the capillaries into the surrounding tissues. This ability has earned them the name of "wandering" cells. The principal job of the white corpuscles is to fight germs. Their method of fighting is to eat up the germs. An infected cut is like a battlefield covered with the bodies of white corpuscles and germs that have died fighting each other. The pus which collects around a splinter under the skin or in an infected cut or scratch or pimple gets its yellowish-white color from dead white corpuscles.

The clear liquid part of the blood is made of water, protein materials, and mineral salts. This liquid also contains food substances, which the blood carries around to the cells after receiving them from the small intestine, and waste substances on the way to the kidneys to be removed from the body.

Foods That Make Red Blood

Blood is made of the food you eat. In a way it is like a grocery boy who is both a customer for and a carrier of food. The blood corpuscles are the chief customers for iron. The amount of iron in the whole body is less than the weight of a penny. Most of this iron is contained in the red corpuscles. Red corpuscles do not have very long lives. New ones must be manufactured every day to take the place of the ones that have died. Part of the iron in the dead cells is saved and used to make new corpuscles, but this scrap iron is not enough. You must also eat each day some foods which contain iron in order to supply your body with enough iron to make strong, plump red corpuscles.

Egg yolk, liver, molasses, dried beans and peas, whole-grain bread and cereals, spinach, dried apricots, raisins, prunes, dates, figs, and other fruits and vegetables are all good sources of iron.

© G. A. Douglas, from Gendreau

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In what way may a grocery boy be compared to the blood stream?

In the liquid part of the blood many minerals are always present. The mineral salt that blood contains in the largest amount is sodium chloride. You do not need to worry about having enough sodium chloride, as it is ordinary table salt.

The other minerals which are present in blood come chiefly from milk, green vegetables, and fruits. When vegetables are boiled, most of the minerals they contain dissolve in the cooking water. In many homes precious minerals that are needed by the body go down the drain pipe with the water in which cabbage or spinach or other green vegetables have been boiled. The next time your mother has a boiled green vegetable for dinner, ask her if she plans to use the vegetable water in cream sauce or soup.

THE WORK OF THE HEART

If you have a watch with a second hand, or can borrow one, keep your eyes on the hand as it travels halfway around the minute dial. During the thirty seconds that it takes the second hand of the watch to make half a round trip, one drop of your blood has made a complete round trip from your heart through your body and back to the heart again. In order to drive blood through the closed tubes which branch out all over your body, a powerful pump is needed. The heart is that pump. Really, it is two pumps placed side by side, for the heart is divided through the middle by a thick wall. There is no connection whatever between the two sides of the heart. The two pumps work at the same time, but they handle different kinds of blood.

The blood which flows into the right side of the heart is blood which has come back to the heart after its round trip through the body. It does not contain much oxygen

and is full of carbon dioxide which it has collected from the cells. This blood is dark blue in color. You can get some idea of its color by looking at the blue blood vessels which lie near the surface of your skin on the underside of your wrists. These blood vessels are veins. They look blue because the blood flowing through them is bluish in color. The veins are the tubes that carry blood back to the heart.

What Happens in the Lungs

From the right side of your heart this dark bluish blood is pumped to the lungs through a blood vessel called an artery. The arteries are tubes that carry blood away from the heart. You cannot see any of your arteries because they lie deep under your skin.

The lungs are made up of tiny thin-walled bags called air sacs. The walls of these sacs are elastic. They stretch like tiny balloons to hold the air that enters your lungs every time you breathe in. A fine network of capillaries is located in the walls of each air sac.

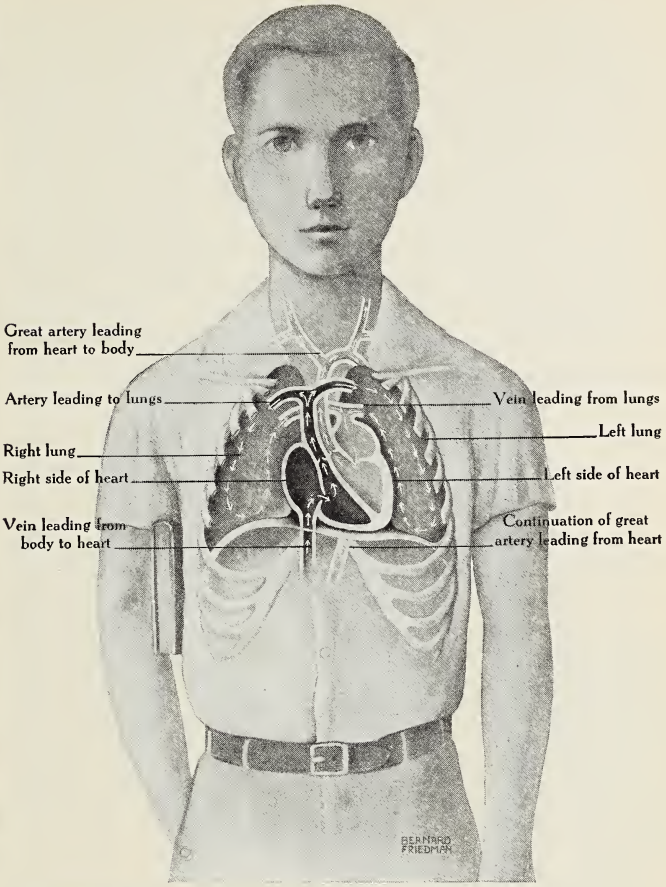
When you breathe in, all the little air sacs are filled with air containing 21 per cent of oxygen and a very small amount of carbon dioxide. The oxygen passes through the walls of the air sacs and through the walls of the capillaries into the blood stream. As the red blood corpuscles carried in the blood stream pass along in single file through the capillaries, each one takes on a load of oxygen. At the same time it unloads carbon dioxide, which it has collected from the cells of the body. The carbon dioxide unloaded from the red corpuscles passes through the walls of the capillaries into the air sacs. When you breathe out, the elastic walls of the air sacs spring together to help drive out the air. All this happens each time you breathe in and out.

How Blood Travels through the Body

After the red corpuscles have taken on a load of life-giving oxygen in the lungs, the blood is bright scarlet in color. This scarlet blood is gathered up by veins in the lungs and carried to the left side of the heart. From there it is pumped out into a great artery to begin its round trip through the body. This artery is like the trunk of a tree. Its branches are a whole system of arteries which grow smaller and smaller the farther away they get from the main trunk. The smallest arteries divide into the tiny thin-walled blood vessels called capillaries through which liquid food and oxygen can pass. From the capillaries the blood is gathered up by veins which carry it back to the heart.

The arteries which carry the blood from the heart are like pipes with elastic walls. Blood is forced by the heart into the arteries in spurts or jerks. Between spurts there is a little pause, just as there is a pause between the ticks of a clock. In order to take care of each spurt of blood as it comes, the arteries stretch and then spring back to their regular size. Thus, instead of flowing smoothly through the arteries, the blood flows in waves. The beat of the waves against the walls of an artery can be felt most plainly in the wrist, in front of the ears, and in the side of the throat. This beat is called a pulse.

The doctor places his finger on the pulse in your wrist when you are ill in order to find out how fast your heart is beating. By beating faster or slower than it usually does, the heart shows that there is trouble in the body. When all is well, the heart of a boy or girl usually beats about ninety times a minute. A grown-up person's heart beats about seventy-two times a minute.


Great artery leading from heart to body
Artery leading to lungs
Right lung
Right side of heart
Vein leading from body to heart
Vein leading from lungs
Left lung
Left side of heart
Continuation of great artery leading from heart
BERNARD FRIEDMAN

A diagram showing how blood travels from the body →
to the right side of the heart → to the lungs →
to the left side of the heart → and out to the body again

When the Heart Rests

Probably you think of your heart as working night and day without rest. This is not true. The real work of the heart is done when its walls squeeze together to pump blood into the arteries. You know that when you squeeze a rubber bulb to force out air or water, the bulb must come back to its original shape before you can squeeze it again. The heart also must come back to its original shape and fill with blood flowing in from the veins before it can squeeze together again to force the blood out. During this slight pause between beats the heart rests. In twenty-four hours these pauses total about fifteen hours. So your heart really works only nine hours a day.

TAKING CARE OF YOUR HEART

Your heart started to beat long before you were born, and it will keep on beating until you die. It is self-working. While it is working well, you do not have to think anything about it. But if it does not work properly, it must be watched and guarded. Boys and girls with weak hearts can find many ways of having good times, but they cannot run and play games requiring vigorous exercise and have the same fun that boys and girls with strong hearts can have. Does your heart beat with pride when the doctor tells you it is sound and strong? It ought to.

The heart does not require any special kind of food. If you eat the foods your whole body needs for growth, energy, and general good health, your heart also will be well fed.

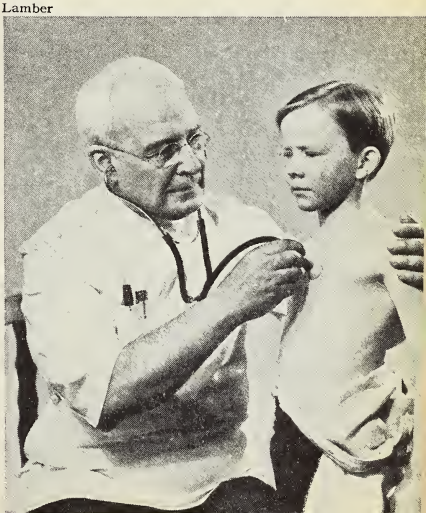
The harder you work or play, the faster your heart must pump blood loaded with fuel food and oxygen to the working muscles. If your heart is healthy it can easily do this

extra work. However, it is possible to overwork the heart. If you exercise too hard or too long, the heart has very little chance to rest between beats. A good rule to follow is to go slowly when you are learning a new game or sport. If you wish to play vigorous games, such as football or basketball, which put a great strain on the heart, your heart should be examined by a doctor. The doctor will tell you whether your heart is strong enough to stand the strain.

Have you ever heard people speak of a marathon? Long ago in Greece, the men of the city of Athens won a great battle at a place called Marathon. It was very important for the news of this victory to reach their city, located a little more than twenty-six miles away. A fast runner was sent to carry the message. Onward he sped over the rough roads never stopping for rest. When he reached the market place of the city, he was just able to gasp out, "Be glad, the victory is ours." Then he fell dying to the ground. His heart was not able to stand the sudden great strain of that race.

Today athletes still run the marathon, which takes its name from that famous event in ancient Greece. Usually they race each other to see which one can cover the distance of twenty-six miles and three hundred and eighty-five yards in the fastest time. But untrained athletes are not allowed to enter

Lamber



By listening to the heart through an instrument called a stethoscope, a doctor can tell whether the sounds he hears are being made by a healthy heart

Acme

Getting away to a good start in a marathon race.
What sort of training have the runners had?

the race. The runners begin training by running a short distance frequently and increasing this distance as their muscles and their hearts grow stronger. The way in which runners train for the marathon is a good way for boys and girls to train their muscles for vigorous games. Strong muscles are not made in one race or in one game. They grow in strength through weeks and months and years of play and work.

Have you ever had measles or a bad cold or sore throat or any other sickness which kept you in bed for several days? If so, do you remember begging your mother and the doctor to let you get up when you began to feel better? How did you feel when you were at last allowed to get out of bed? Most people who have had to stay in bed for a while feel weak when they first get up. They are glad to go back to bed again after an hour or so of trying to sit

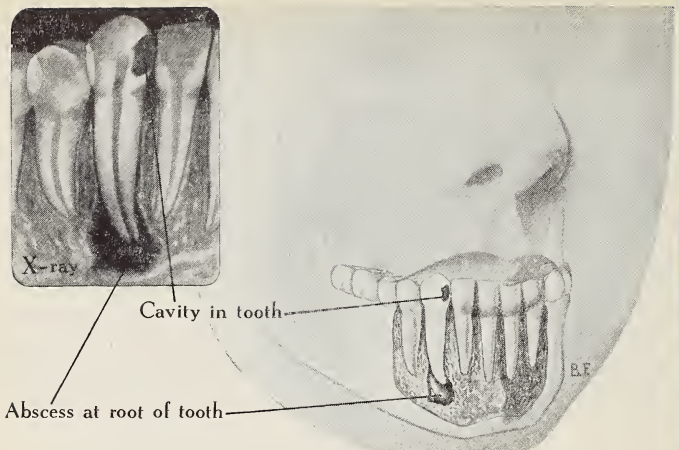
up or walk. The heart has to work harder when a person is sick, especially if there is fever. When the sick person begins to get well, the heart needs plenty of time to rest from the strain put on it by the illness. This is why a doctor often keeps a person in bed for several days after the sickness has been cured.

The heart may be injured also by germs or their poisons which may be carried to it from a center of infection, such as abscessed teeth or diseased tonsils or a diseased adenoid. The doctor and the dentist know how important it is for boys and girls to have strong hearts. If the doctor who gives you your yearly physical examination finds that you have diseased tonsils or a diseased adenoid, or if your dentist finds a bad tooth, listen carefully when he tells you and your parents what ought to be done about it. He is trying to help you to protect your heart and other organs from harm.

When you are sitting down, your heart beats more slowly than when you are standing up. It beats more slowly still when you are lying down. The heart gets more rest during sleep than at any other time because there are fewer beats to the minute and a longer rest period after each beat. Boys and girls of your age need from ten to eleven hours of sleep each night in order to give their hearts enough rest.

DRUGS THAT MAY HARM THE HEART

Certain common substances which seem to give many people pleasure contain drugs that make the heart beat faster. These substances are coffee, tea, drinks which contain alcohol, and tobacco. Although alcohol speeds up the heart, it does not increase the amount of blood pumped



How may infection in a tooth injure the heart?
What is one important reason for going to the dentist twice a year?

from the heart over a certain length of time. The strain placed on the heart by heavy drinking may weaken it after a while. The presence of alcohol in the body irritates the various organs with which it comes in touch. The walls of the blood vessels especially may become weak and flabby. The red nose of the drunkard is a sign that the blood vessels in the skin have become so stretched that they always contain too much blood. The walls of the heart also become stretched, and clogged with fat.

Tobacco was unknown to the civilized world up to the time of the discovery of America. A few days after Columbus landed in the New World, he found the Indians using tobacco in a very peculiar way. They had a hollow stick in the shape of a Y. The two upright limbs of the Y were placed in their nostrils, while the stem was placed in

the smoke of burning tobacco. The Indians breathed the smoke through the hollow tube directly into their nostrils. Early explorers of America took tobacco to Europe.

The habit of smoking tobacco soon began to spread all over the world. Many people tried to stop its use. In Russia in the seventeenth century the noses of smokers were cut off. James I of England called smoking "a custom loathsome to the eye, hateful to the nose, harmful to the brain, and dangerous to the lungs." Since the days of Columbus and King James I people have argued for and against the use of tobacco.

There are a number of harmful drugs in tobacco, but the principal one is nicotine. Fortunately for those who smoke, so little of the nicotine finds its way into the blood that there is no danger of its causing death, although it may do the body some injury. People who limit themselves to smoking a few times a day may not be harmed by tobacco. But too much smoking is likely to be harmful and even dangerous.

Sometimes a doctor orders a person not to smoke or to smoke less because the heart or the nerves have been injured by the drugs in the tobacco. Perhaps a young man or woman who smokes may want to get on an athletic team in college. Athletes are not allowed to smoke because of possible injury to the heart or the breathing muscles. Many employers do not allow their employees to smoke while on duty. If a person is used to smoking a great deal, it is hard for him to stop smoking when for any reason it becomes necessary to give up the habit. Although there is a difference of opinion as to the effects of tobacco on persons who have grown up, all doctors say that if tobacco may be used at all, young people should wait until they are at least twenty-one years old before they start to smoke.

ARE YOU DOING YOUR BEST TO KEEP YOUR HEART AND BLOOD IN GOOD CONDITION?

Do you play out of doors every day?

Do you stop playing before you begin to be very tired?

Do you sleep ten or eleven hours every night, and rest during the day after hard work or play?

Do you drink milk and eat green vegetables and fruit every day?

Do you eat an egg every day or one at least four times a week?

Do you have a physical examination once a year, and do you go to the dentist as often as he thinks necessary?

1. Choose the correct ending for each of the following sentences. (*Do not write in the book.*)

a. The liquid surrounding the body cells is · (1) blood (2) lymph · (3) water.

b. The blood vessels through which food and oxygen pass out to the liquid surrounding the cells are · (1) the capillaries (2) the veins · (3) the arteries.

c. The blood vessels into which digested food passes are located in · (1) the heart · (2) the stomach · (3) the small intestine.

d. Oxygen is carried from the lungs to the body cells by (1) the white corpuscles · (2) the red corpuscles · (3) the liquid part of the blood.

e. Blood is carried back to the heart after its round trip through the body by · (1) the veins · (2) the arteries · (3) the villi.

f. The arteries are blood vessels which carry blood (1) away from the heart · (2) toward the heart · (3) away from the lungs.

2. Which of the following practices are good for the heart and blood? Which are harmful? Give a reason for each choice. (*Do not write in the book.*)

a. Having a quart of milk each day.

b. Eating green vegetables and fruit every day.

c. Going to the motion pictures three or four nights a week.

d. Eating an egg a day.

e. Having a doctor give you a health examination each year.

f. Doing everything you can think of to keep from going to the dentist.

g. Playing or working until you are "ready to drop" with tiredness.

h. Spending ten or eleven hours every night in sleep.

i. Staying in bed after you have been ill until the doctor says you may get up.

j. Smoking "on the sly."

k. Drinking coffee or tea instead of milk.

l. Using the water in which vegetables have been boiled for soups and sauces.

THINK ABOUT THESE QUESTIONS

Suppose eyes, hearts, arms, and legs were for sale. What are some of the things you would look for in a heart if you were choosing one? You know that there is no store in the world in which you can buy a new heart to replace a damaged one. Your heart and all the other organs in your body are meant to last a lifetime. Do things last longer and give better service when they are given good care? What are some of the things you do to take care of a watch or a camera or a bicycle or any other of your belongings which you would find very difficult to replace? What are some of the things you can do to take care of your heart so that it will wear well? Why is playing too hard or too long bad for the heart? Why is a long night's sleep good for it? How may diseased tonsils harm the heart?

Galloway

DO THESE THINGS

1. Find the pulse in your wrist. Locate the pulse in front of your ears and the pulse at the side of your throat. While you are sitting quietly, place a finger on the pulse in your wrist and count the number of beats per minute

"

Find the pulse in your wrist as this girl is doing

with the aid of a watch that has a second hand. Count your pulse again a few minutes after you have been playing hard.

Count your pulse before and after meals; while standing, sitting, and lying down; and just before you get out of bed in the morning. Remain a few minutes in any position before counting the pulse in order to allow the heart to get used to the new position. After making these tests explain why the heart beats faster or slower according to what you are doing.

2. Make menus for breakfast, lunch, and supper, and have in each menu a food which contains iron. Point out this food by placing a little star above it.

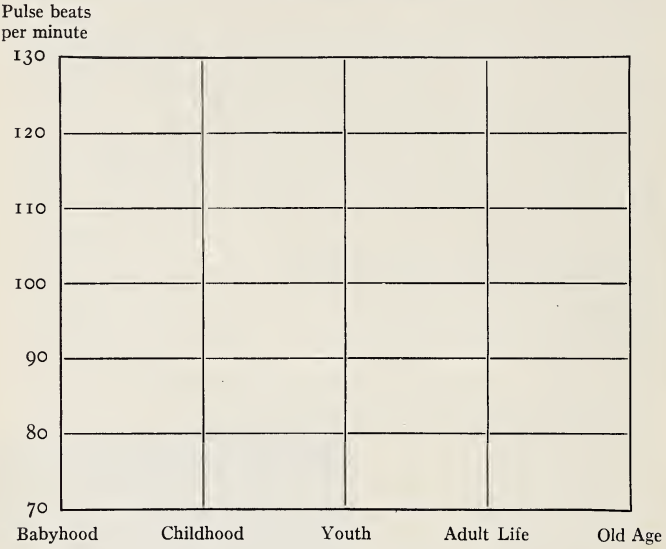
3. Keep a record of the time you spend during twenty-four hours in the following activities. (*Do not write in the book.*)

	Hours
Washing, brushing teeth and hair	__?__
Dressing and undressing	__?__
Meals	__?__
Going to and from school	__?__
School	__?__
Recreation (play, reading for pleasure, etc.)	__?__
Home chores	__?__
Home study	__?__
Rest during day	__?__
Sleep at night	__?__
Other things	__?__
Total	24 hours

Let 100 stand for the whole twenty-four-hour period. Figure out what per cent of your time you spend for each activity. Compare lists in class. Discuss these questions:

Should more time be given for meals and sleep?
Should more time be given to rest during the day?
Should more time be spent in recreation?

4. Perform the following experiment to find out the effect that size and age have on the speed of the heartbeat. Count a little baby's pulse; a kindergarten child's pulse; your own pulse; the pulse of your teacher or your father or mother; the pulse of an old person. The count should be taken some time after a meal and when the person is sitting quietly. Copy the following and report what you have found as a graph. (*Do not write in the book.*)



5. Find out something about William Harvey, the man who proved that the blood moves in a circle from the heart and back to it. When did he live? What country did he live in? When did he tell the world what he learned about the motions of the blood? What was the good of his great discovery? Talk over this question in class: How does a knowledge of the heart and its work help us to take care of it?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

capillaries	sodium chloride	nicotine
microscope	vein	loathsome
carbon dioxide	artery	employer
clot	air sacs (in lungs)	employee
red corpuscles	pulse	
white corpuscles	marathon	

2. Match each group of words in the list below with a word or expression in the list above that you connect with it. (*Do not write in the book.*)

a waste gas produced by the burning of fuel food in the body
a race over a distance of twenty-six miles and three hundred and eighty-five yards
a person who has other people working for him
thickening of the blood over a cut
a person who works for another person
a poisonous drug in tobacco
table salt

UNIT VI

Growing Bones and Working Muscles

Have you ever drawn a human figure by making a circle for the head, a straight line for the trunk, and other straight lines for the arms and legs? This is called a "stick" drawing. A stick drawing shows the main parts of the human skeleton—the round skull, the straight spine, or backbone, and the bones of the arms and legs. The fact that stick drawings can be used to represent people shows how much the skeleton has to do with the appearance of a human being. What do the stick drawings used to illustrate the picture story of Arthur and Bill tell you about the appearance of the two boys?

Your bones give you your shape because the skeleton is the framework of your body. Muscles fastened to your bones hold them in place and move the movable ones. Food supplies your bones and muscles with building materials and gives your muscles the power to move. You can easily see that the kind and amount of food you eat will make a great difference in your shape and in your ability to work and play.

The bones of boys and girls are like the limber green stem and branches of a young tree. The older you grow, the stiffer your bones become, just as the trunk and branches of a tree grow stiffer with age. As you grow, your bones develop the shape they will have when you are older. Which shape should you rather have when you grow up, Arthur's shape or Bill's shape?

1. ARTHUR WAS ON THE WAY TO GET A JOB DELIVERING PACKAGES ON SATURDAYS.

2. HE SAW BILL HURRYING ALONG AHEAD OF HIM. "WAIT FOR ME, BILL," CALLED ARTHUR.

3. "WHERE ARE YOU GOING?" ASKED ARTHUR WHEN HE HAD CAUGHT UP WITH BILL.

4. "I'M GOING TO SEE MR. JONES ABOUT GETTING A JOB DELIVERING PACKAGES ON SATURDAYS," SAID BILL.

5. "WHY, THAT'S WHERE I'M GOING," SAID ARTHUR.

6. WHICH ONE GOT THE JOB, ARTHUR OR BILL ?

Growing time is the time to build the sort of body you would like to have all through life. It is also the time to gain the skill that will help you to do well everything that requires the working together of your muscles and bones and brain.

DO YOU KNOW

How bones grow?

What bones are made of?

Which muscles behave as you wish them to behave?

Which muscles work all by themselves?

How to find out the amount of energy food you need each day?

Why exercise gives you a good appetite?

The difference between the muscles you use in chewing and the muscles of your stomach?

You are as tall as your bones. Growing taller means that your bones are growing longer. You can find out whether your bones are longer this year than last year or only a few months ago when you are measured for height in school or at home. It is a good plan to be measured every six months. Then you know whether or not your bones are growing as they should.

Have you ever tried to chew a piece of gristle in meat? It is a firm elastic tissue which is too tough to be chewed into fine bits and swallowed. The scientific name for gristle is cartilage. All your bones were once rods or pieces of cartilage. When you were born, your skeleton was partly cartilage and partly bone. It will not be all bone until you are more than twenty-one years of age. The cartilage keeps on growing until it is completely changed to bone. When this happens, further growth ceases. Thus while you are growing there is a race between the growing cartilage and the forming bone. On the result of this race your height and the length of your arms and hands and feet depend.

What Bones Are Made Of

If you have watched the butcher cut off a slice of beefsteak, you know that he saws through the bone in the meat with a little saw. The cut end of the bone bleeds as well as the cut muscles. The blood comes from blood vessels that run through tiny tunnels in the bone. Nerves also run through these bone tunnels. Surrounding each tunnel and connected with it by still smaller tunnels are the bone cells.

The bone cells receive from the blood the materials with which they build the solid parts of the bone. These

materials are the same as those which the tooth cells use in building teeth—calcium and phosphorus. Vitamin D, which helps the tooth cells to mix the calcium and phosphorus and deposit it in layers to form teeth, also helps the bone cells to mix these materials together and form bones.

"

The diagram in the circle shows the cut end of a long bone. The tiny circles are the cut ends of tunnels in the bone through which nerves and blood vessels run. The small black dots are bone cells

Galloway

The parts of the bone which are alive—the cells, blood vessels, and nerves—make up about one third of the weight of a bone. As this living material is mostly water, bones, which we think of as the driest part of the body, are really about one-third liquid. The rest of the bone is a hardened mixture of calcium and phosphorus, which is not alive. If you heat a bone in a hot oven long enough, the watery part which was once alive will dry up. Then the bone is very white, stiff, and brittle. You can crush it with your fingers. If you soak a bone in an acid, such as hydrochloric acid, the calcium and phosphorus are dissolved. The bone is then tough and elastic. It is so free from stiffness that it can be tied in a knot.

Children who do not get enough sunshine in the summertime and cod-liver oil or some other food source of vitamin D in the wintertime may have soft bones because their bodies are unable to use calcium and phosphorus in bone-building. Their bones are easily bent out of shape, just as a bone soaked in hydrochloride acid may be twisted out of shape. Children whose bones are soft have a disease called rickets. A child who has rickets may have bowlegs and a poorly shaped head and chest. His teeth also are likely to be soft and crumbly. Babies who are given sun baths and who have enough milk and cod-liver oil or vitamin-D milk never develop rickets.

WORKING MUSCLES

All the physical work of the body is done by the muscles. The muscles which move the bones move at the command, or will, of the thinking part of your brain. You can make your bones move or not move, exactly as you wish. You do not, of course, give direct orders to each one

Steven A. Coons

What kind of muscles is this boy using to perform the act of sawing wood?

of the muscles which work your bones when you walk, stand, dress, write, or play games. However, you know when you are walking, standing, dressing, writing, or playing games, and you know that you can perform these actions or stop performing them just as you choose. Therefore, the muscles which are fastened to and move or support the bones of the skeleton are called voluntary muscles. *Voluntary* comes from the Latin word *voluntas*, which means "will." The muscles attached to your skeleton come forward at the call of your brain to help you perform all your willing, or voluntary, acts.

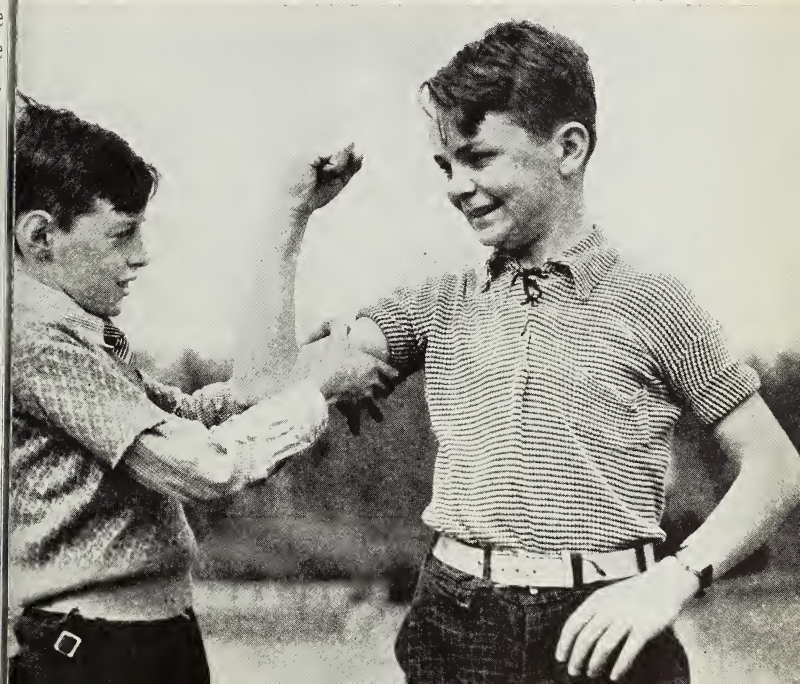
In reading about what happens to the food you eat, you learned that the walls of your esophagus and stomach and of the large and small intestines are moved by muscles which are enclosed in the walls. After food has once been chewed and swallowed with the help of the voluntary muscles in your jaws and in the back of your throat, you cannot then start or stop the digestion of this food as you can start or stop chewing it. You have probably had the experience of eating too much at a Thanksgiving dinner or a Christmas dinner. Perhaps your stomach felt unpleasantly full. But there was no possible way in which you

could make your stomach muscles work faster in order to move the food out of your stomach more rapidly.

The motions of all the muscles inside the hollow organs of your body, such as the stomach, the small intestine, the heart, and the blood vessels, are involuntary. That is, you cannot start or stop their movements. The involuntary muscles are not under the control of the willing part of your brain. They are the muscles which carry on the work of the body which is necessary to keep you alive. This important work is the duty of a machine which works all by itself. You would have too much to do if you had to boss everything that goes on in your body. You have all you can do to take care of your relations with the outside world.

"Just feel my muscle!" Are you proud of yours?

Lambert



Lambert

The amount of gasoline an automobile needs in a day depends on its size and the number of miles it is driven

Your Responsibility toward Your Muscles

It is not necessary for you to bother about the business of keeping alive. But it is necessary for you to pay attention to the business of keeping your body in good working order. If you have ever been in a factory, you know that a man stands beside each machine. The machine may be able to work all by itself, but it must have the attention and care of someone who can think for it. The machine is helpless when something goes wrong or when it needs oiling or fixing. You are responsible for the good work of your involuntary muscles as well as of your voluntary muscles. Everything you do which has an influence on your health influences also the work of the self-working part of your body machinery.

Over your voluntary muscles you have almost complete control. You can make them behave as you wish them to behave. You can make them strong or you can allow them to become flabby, just as you wish. You are responsible for training your muscles to hold your body tall and straight. You are responsible for training your brain and your voluntary muscles to work well together so that you can do skillfully and safely everything you have to do in work and play.

How the Muscles Get Energy to Work

The ability of your muscles to work comes in the first place from the sun. However, the direct rays of the sun do not give your muscles the power to move, as water flowing directly against a mill wheel makes the wheel turn. The energy from the sun is stored in food. This energy is let loose in your body when the muscles burn the fuel food substances, just as energy is let loose when fuel is burned in an engine. You have learned that calories are used in measuring the amount of fuel food you need for your activities. The number of calories you need each day depends on what you do and what you weigh and how old you are.

The number of calories boys and girls need in a day depends on their size and their age and what they do

Galloway

Does your family own an automobile? If so, you know that after going a certain distance the car must be filled up again with gasoline. Even if the car is driven for only one block, it uses up some fuel. If it is driven several miles, it uses up more fuel. The number of miles the car is driven determines the amount of gasoline it uses. What you do each day determines the number of calories you use.

Have you ever heard an older person say how many miles a certain car will go on one gallon of gasoline? If it is a big car, it may go only nine or ten miles on one gallon. If it is a small car, it may go twenty miles or more on a gallon. Just as a big car uses more gasoline per mile, so a big boy or girl uses more calories in doing different things than a small boy or girl uses in doing the same things.

While you are growing, there is more activity inside your body than there will be when you stop growing. It takes more work to build a new automobile than it does to keep an automobile in good repair after it has been built. Growing boys and girls use a great many calories just in growing. This is why it is natural and right for boys and girls to have big appetites. They are doing something that grown-up people have already done. That is, they are growing up, and they need energy for growth as well as energy for play and work and for the repair of worn-out tissues.

You have learned the number of calories that a boy or girl of your age usually needs in one day. You may like to work out for yourself how many calories you use in doing different things. When you are asleep, you use calories only for growing and for the work of the muscles that keep you alive. If you lift so much as a little finger, the number of calories you need is increased. You use the most calories when you are working or playing hard. By using the following table you will be able to find the number of calories you need for different activities.

Kind of Activity	Calories per Hour per Pound of Body Weight
Sleeping	0.43
Lying quietly in bed awake	0.50
Sitting at rest	0.65
Sitting at work (studying, sewing, writing, reading aloud, eating)	0.70
Dressing, undressing, taking a bath	0.81
Standing relaxed	0.69
Standing stiffly	0.74
Walking slowly	1.30
Walking fast	1.95
Light exercise (setting table, wiping dishes, and doing other light housework)	1.10
Active exercise (playing outdoor games)	1.88
Swimming	3.25
Vigorous exercise (running very fast)	3.70

To find out how many calories you use in doing a certain thing, multiply the hours or fraction of an hour spent in that activity by the number of calories required per hour. Then multiply the answer by the number of pounds you weigh.

Examples

Activity	Hours		Calories per Hour		Weight in Pounds	
Sleeping	10	×	.43	×	84	= 361.20
Studying	1½	×	.70	×	84	= 88.20

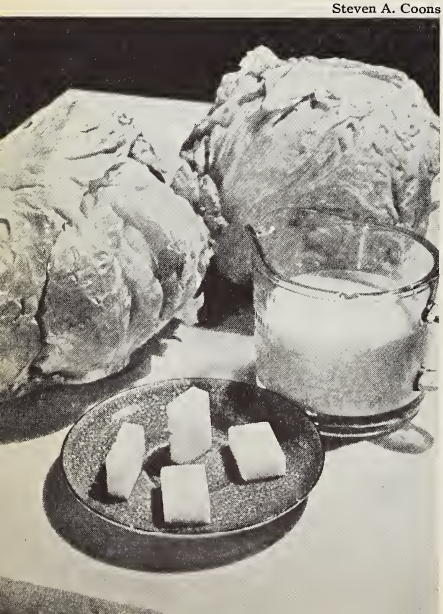
You may use this table and the foods listed according to 100-calorie portions on pages 255–256 to find out the amount of food which will supply you with the calories needed to do different things. For example, how much milk would give you the energy to study for an hour? How much lettuce should you need to eat to get the same amount of energy? How much sugar should you need?

If your muscles needed calories only, about a pound and a quarter of sugar or candy a day would supply your muscles with everything they need. But your muscle cells need more than calories because cells wear out with use, and because your muscles grow as you grow.

The muscles need building materials as well as fuel. They must have proteins, minerals, water, and vitamins in order to grow bigger, to repair worn-out parts, and to do their work properly. Your muscles use food to grow on as well as food to go on. Milk, cheese, eggs, meat, fish, green vegetables, and fruits are the foods that help you to grow strong muscles.

Not having enough of the right kinds of food may make a boy or girl feel tired all the time. Do you remember how the plants which you grew in sawdust looked after a while? Boys and girls may look wilted and feel tired and weak if they do not have enough calories for work and play and enough building material for muscle-building and repair.

Steven A. Coons



Does exercise give you a good appetite? The reason you have a good appetite after playing outdoors is because your muscles have used up so much fuel food that the body demands a new supply by making you hungry. But if you play or work too hard or too long, you may feel too tired to eat. It is best to stop playing

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The amounts of lettuce, milk, and sugar shown in this picture each supply 100 calories

Galloway

Do you think these boys will have a good appetite for supper? Why?

when you feel pleasantly tired and hungry. Then you are ready for a rest and a good supper and a long night's sleep when bedtime comes.

Some boys and girls get tired very easily. Halfway through a game they may have to drop out and rest. They may look pale and have dark circles under their eyes before the school day is over. Boys and girls who cannot keep up with their playmates in games or schoolwork or who feel tired most of the time should ask their parents to take them

to a physician. In some cases the teacher or the school nurse can arrange to have the school doctor examine such boys and girls.

Taking Care of Your Muscles

Have you ever strained a muscle? Boys sometimes strain their muscles when they try to lift something too heavy for them. A girl may strain an ankle because the heels on her shoes are too high. Playing a vigorous game for too long a time, doing muscular work you are not used to doing, or running too far may result in strained muscles. A strained muscle may feel stiff and sore and need rest for several days. Sometimes the strain is so painful that a doctor or nurse must bandage the muscle so that it can have complete rest. Light rubbing, soaking the strained muscle in hot water, or putting on hot cloths sometimes helps to relieve the pain.

Usually your body becomes covered with sweat, or perspiration, when you exercise vigorously. By the evaporation of this moisture your body gets rid of the extra heat produced by the working muscles. Too rapid evaporation of sweat may cause chilling of the body. Getting chilled after playing hard out of doors may make your muscles feel sore and stiff later on. Chilling may also cause you to catch cold, because the ability of the body to fight cold germs is weakened when the body temperature is lowered.

If you feel hot and damp after a game, wrap up warmly and go home as fast as you can. Take a bath, rub yourself hard, and put on dry clothes. Many schools have showers where boys and girls may bathe after playing in the gymnasium or on the school playground. Soaking in a hot bath at night after a long hike or a vigorous baseball or football game will often prevent sore muscles.

ARE YOU DOING YOUR BEST TO GROW STRAIGHT BONES AND STRONG MUSCLES THAT WORK WELL TOGETHER?

Do you eat each day foods that supply your bones and muscles with building materials?

Do you eat enough to have plenty of energy for work and play?

Are you training your muscles to hold your body straight?

Do you play outdoors with other boys and girls every pleasant day?

Do you stop playing when you begin to feel tired?

Do you wrap up warmly when you are damp with sweat after vigorous play?

1. Match each word or group of words in the box with the word or words in the list below the box that you connect with it. (*Do not write in the book.*)

cod-liver oil	muscles in the walls of the stomach
phosphorus	cartilage
muscles which move the bones of the arm	rickets
water	calcium
milk	

gristle
bone-building materials
the best food source of bone-building materials
a good food source of vitamin D
substance which forms one third of the weight of bone
a disease marked by soft bones
an example of voluntary muscles
an example of involuntary muscles

2. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. The number of calories you need each day depends on how hungry you are for meals.

b. You use the most calories when you are asleep.

c. Milk supplies the muscles with building materials as well as with calories.

d. Not having enough of the right kinds of food may make a boy or girl feel tired all the time.

e. The longer you continue playing a vigorous game after school, the better your appetite will be for supper.

f. When you are hot and tired after playing outdoor games, it is a good plan to take a shower, put on dry clothes, and rest before supper.

THINK ABOUT THESE QUESTIONS

1. What are some of the ways in which housework, farm work, and travel are now easier than they used to be? What are some of the occupations in which little exercise is required? What sports are you becoming skillful in now that will give you an enjoyable form of exercise when you grow older?

2. What two materials do the bone cells use in building the solid parts of bone? What food is the best source of these materials?

3. Why is it possible that a boy or girl may need to take in more calories than an older, bigger person doing office work may need to take in?

DO THESE THINGS

1. List ways in which milk may be used in preparing food. Ask your mother for two or three favorite recipes in which milk is used. Form a class committee to collect all the recipes into a milk cookbook. If the school has a printing press or a machine for making several copies of handwritten or typewritten sheets, it may be possible for each boy or girl to have a copy of this book to take home.

2. Obtain a small amount of calcium phosphate from a druggist. This substance is a mixture of the two minerals out of which bones are made. What are these minerals? Get a fresh bone from the butcher and weigh it. Ask your mother to let you put the bone into the oven to dry out when she uses the oven for baking. Leave it there until it is burned completely dry. Weigh it again. What per cent of the bone was liquid? Crumble the dry bone to powder. Does it look anything like the calcium phosphate obtained from the druggist?

3. Perhaps your teacher or the science teacher in your school will place a bone in hydrochloric acid mixed with water, so that you can see what the bone is like when the acid has eaten away all the minerals in the bone. Does the softness of the bone suggest to you why it is that children may have bowlegs or poorly shaped heads or chests when they do not have enough of the vitamin which helps them to use the bone-building materials in food? What is this vitamin? How do you obtain it?

4. Keep a record of everything you do for twenty-four hours and the amount of time you spend in each activity. Do not try to be too exact. Use your own judgment in deciding whether to call an activity light or vigorous. Using the table and the directions given on page 137, work out the number of calories you used during the twenty-four hours. Using the table on pages 255–256, work out the number of calories in the food you ate. Compare the number of calories you used with the number of calories you took in. Did you take in enough? Did you take in too few or too many? If you did not take in enough calories, how much whole-wheat bread and butter or brown cereal and milk would you have to eat to make up the number you need?

5. Members of the class may test one another for good posture. Here is how to make the test. Tie a weight of some kind to one end of a string. A, the person to be tested, should stand as he usually does. B, the person making the test, should hold the string so that it hangs straight down to the floor from a point just in front of A's ear. If A's posture is good, the string will pass through the middle of the shoulder joint, the middle of the hip and knee joints, and the middle of the ankle joint. The weight will strike the floor just in front of the heel.

Talk over in class the benefits of good posture. How may eating the right kinds of food, playing out of doors every day, and getting enough sleep every night help a person to have good posture?

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

cartilage	hydrochloric acid	involuntary muscle
brittle	rickets	calcium phosphate
portion	voluntary muscle	

2. From the list above select the word described by each one of the following groups of words:

a muscle that acts at the command of the will
a firm elastic body tissue
a helping of food
easily broken

UNIT VII

The Work of the Nervous System

Madge brought her health book home from school one afternoon. Her brother Paul, who was in the fourth grade, was idly turning the pages as he waited for supper to be ready.

"Oh, look, Madge," he said. "Here's a picture of a walnut. What a funny picture to have in a health book!"

Madge came to look at the picture. "You silly boy!" she said. "Can't you read? That's a picture of the brain."

"I think Paul is trying to tease you, Madge," said Father. "Let me see the picture. It does look like half a walnut kernel, doesn't it? Some people used to think that eating walnuts was good for the brain because half a walnut kernel looks something like the brain."

"What a queer notion," said Madge.

"People have all sorts of queer notions when they don't know how things are made and how they work," said Father.

"I think with my brain, don't I?" said Paul. "Wouldn't it be fine if walnuts really were good for the brain? I'd eat a walnut and then all my arithmetic problems would come out right."

Father laughed. "Everything you eat helps you to think, Paul," he said. "Your brain is made out of food."

"Miss Bell read us a story yesterday," said Madge. "She said it was food for thought. She said that anything that makes the thinking part of the brain work is food for thought."

"Supper's ready," called Mother.

"Hurrah," said Paul.

"I think Paul likes real food better than he likes food for thought," said Father.

"I like both," said Madge.

The nervous system needs two kinds of food. The food you eat makes a great difference in the health of the nerve cells. The food for thought you give your brain makes a great difference in the kind of person you are. Everything you learn from books and from people and from the things that happen to you are food for thought. Your eyes, your ears, your skin, your tongue, and your nose bring knowledge to your brain from the outside world. Your brain uses this knowledge in directing your thoughts, your actions, and your feelings. You may see two people who look very much alike. But you will never know two or more people who think and feel and act alike. No other person has exactly the same food for thought that you have. No other person has exactly the same kind of brain that you have. This is why you are different from all other people.

DO YOU KNOW

In what ways your nervous system may be compared to a telephone system?

Why you can walk without thinking how to do it?

Who Dr. Eijkman was and what he discovered about food?

Which part of the ear makes it possible for you to hear?

Why you cannot see in the dark?

How far away you should hold your book when you read?

Whether you have tears in your eyes only when you cry?

Why food does not have much taste when your nose is stuffed up from a cold?

Why boys and girls in Mexico like food seasoned with red pepper?

Why a drunken man cannot walk in a straight line?

THE TELEPHONE SYSTEM OF THE BODY

The nervous system is made up of (1) the brain, (2) the spinal cord, which runs from the brain down through the hollow backbone, and (3) the nerves, which connect the brain and spinal cord with all the other parts of the body. The nervous system may be compared to a telephone system. The nerves are like the incoming and outgoing wires. The brain and spinal cord are like "Central." They are called the central nervous system. The special organs that receive information about the outside world and send it to Central are called sense organs. The sense organs inform the central nervous system about everything you see, hear, taste, touch, and smell. Nerves running from the brain or spinal cord to the muscles carry the orders which tell the muscles how to act.

The working of your nervous system is illustrated by everything you do. Messages are continually coming to the central nervous system from the sense organs. The brain answers these messages by ordering the muscles to act in a certain way. The orders it gives depend on the knowledge and memories stored in your brain. You learn by experience or from people or books what is best to do, and your brain uses this knowledge to guide your actions. Many of the things you do, however, do not require the

Galloway

A small child learning to dress himself must use the thinking part of his brain until dressing himself becomes a habit

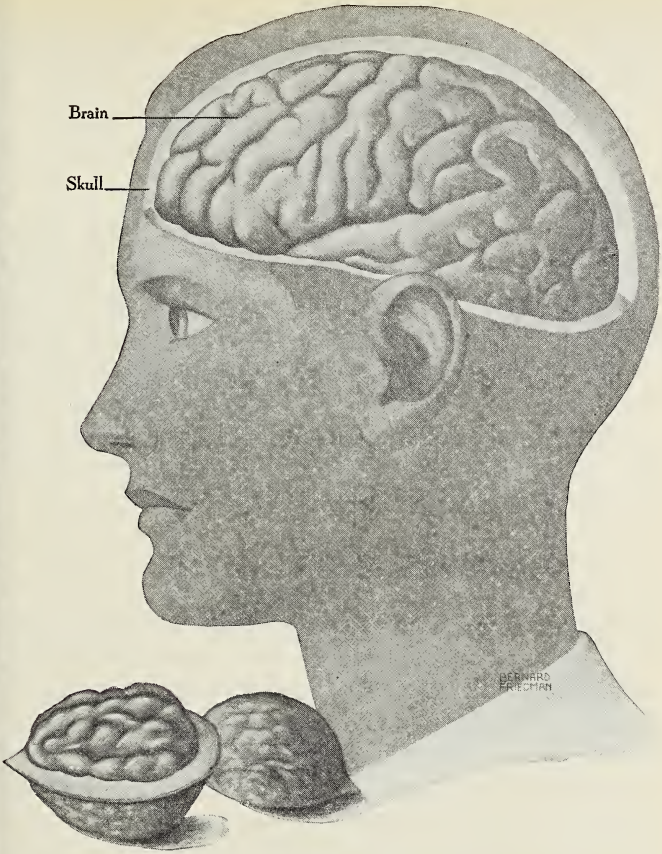
attention of the thinking part of the brain. When something tickles the inside of your nose, for example, you sneeze. You do not need to think before you sneeze. But what do you do when you feel a sneeze coming? Do you pull out your handkerchief to cover your nose? Do you need to think when you reach for the handkerchief? You may have performed this act so many times that now you reach for your handkerchief without thinking. But when you were first learning to sneeze into a handkerchief, you used the thinking part of your brain each time you did it.

Forming Habits

After doing a certain thing over and over again you finally do it without thinking. This is called forming a habit. You can form bad habits as well as good ones. For example, it is possible to grow up without ever learning that a handkerchief should be used to cover a sneeze. It is possible, also, to receive this knowledge and not pay any attention to it. To form good habits people must know the right way to act. They must also have the will to use this knowledge.

The habits of mind which determine the way you act are called attitudes. You can train your mind to form the attitudes of cheerfulness, of courage, and of self-reliance, that is, of depending on yourself instead of expecting other people to do everything for you. You can train your mind to use the knowledge you gain about food, sleep, exercise, fresh air, and sunshine to form good health habits.

Habits are very useful things to have. They save people a great deal of bother. When any action, such as dressing, writing, or walking, becomes a habit, you can do it much more easily and quickly than when you were first learning to do it. When all the different things you must do to have



Why did people once think that walnuts were a good brain food?

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a strong healthy body become habits, you will not need to think about holding your body straight, for example, or eating the right foods, or getting enough sleep. Doing these things will seem the natural things for you to do. When

cheerfulness, kindness, courtesy, and self-reliance become habits, it will be natural for you to be cheerful, kind, courteous, and self-reliant.

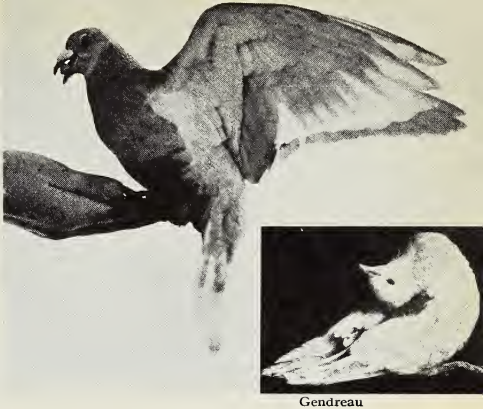
BRAIN FOOD

There is no one special kind of brain food. The nerve cells in the brain and spinal cord take helpings of all the different kinds of food substances carried around by the blood. The foods that supply all the rest of the body with the substances needed for energy, growth, and good health are also the foods that nourish your nervous system and keep it in good working order. But there is one food substance that the nerve cells need especially in order to keep healthy. This substance is vitamin B.

The Story of Vitamin B

Vitamin B has a very interesting story. Between the years 1882 and 1885 a Japanese doctor named Takaki discovered that sailors who had plenty of whole-wheat bread, vegetables, and milk in addition to white rice did not develop a nerve disease called beriberi. Sailors who lived principally on white rice had the disease. People sick with beriberi feel weak and tired all the time. Even if they wish to do something, they feel that they cannot. The reason they cannot is because their nerve cells are starved for vitamin B. Takaki did not know this, of course. No one in his day had ever heard the word *vitamin*. Takaki knew only that a variety of food would prevent beriberi.

A few years later a Dutch scientist named Eijkman was carrying on some experiments with pigeons to find out about different foods. The pigeons were fed only



The healthy pigeon at the left would soon look like the pigeon sick with beriberi at the right if he had no vitamin B in his food supply

Gendreau

rice, and yet they behaved in a strange manner. By turns they were either very sick or perfectly well. The sickness was similar to the human disease beriberi. Eijkman wondered what ailed the pigeons. At last he found out. The boy whose duty it was to feed the pigeons was given money to buy rice for them. In order to keep the money for himself he begged rice of the steward who bought food for the hospital where Eijkman was carrying on his experiments. This rice was white rice that had been polished to remove the brown outer coats. The pigeons became sick and some of them died when they had only the white rice to eat.

Then the hospital steward went away for a while. The boy was obliged to buy the rice. He bought brown, unpolished rice because it was cheaper than the white. Then the sick pigeons began to get well. When the hospital steward came back, the pigeons were fed white rice again. Once more they became sick. When Eijkman discovered what had happened, he realized that the brown outer coats of the rice must contain something which cured the sick pigeons. He gave patients sick with beriberi brown rice to eat. The patients began to get better. Eijkman also found that he could keep people from having beriberi by feeding them brown rice instead of white rice.

Later on scientists discovered in the outer coats of grains the crystal substance which is necessary for the health of the nervous system. This substance was given the name vitamin B. The brown outer coats of grains are rich in vitamin B. It is also found in milk, in yeast, in egg yolk, and in many vegetables and fruits.

Why Vitamin B Helps You to Grow

Scientists have found that vitamin B is necessary for a good appetite. Dogs that are given no foods containing vitamin B lose their appetites. They become less and less interested in food. At last they refuse to eat. When they are given vitamin B, they eat greedily the same foods which they had refused to eat a few hours before.

Doctors have noticed that babies who do not get enough vitamin B have poor appetites. When these babies are given a form of liquid yeast which is rich in vitamin B, they begin to eat food that they had once refused to eat. They change from pale, thin, whining babies into happy, rosy-cheeked, smiling babies. They make remarkable gains in weight because they eat everything given to them instead of refusing to eat.

Vitamin B also aids digestion. The muscles in the walls of the stomach and in the large and small intestines move the food along much more slowly if foods containing vitamin B are not eaten. Doctors have found that many people who have poor digestion or who suffer from constipation do not eat enough foods which contain vitamin B.

Boys and girls who have good appetites and good digestion grow faster and are stronger and healthier than boys and girls who have poor appetites and who do not digest well the food they do eat. This is why vitamin B is so important for proper growth.

Steven A. Coons

Closing the door to sound

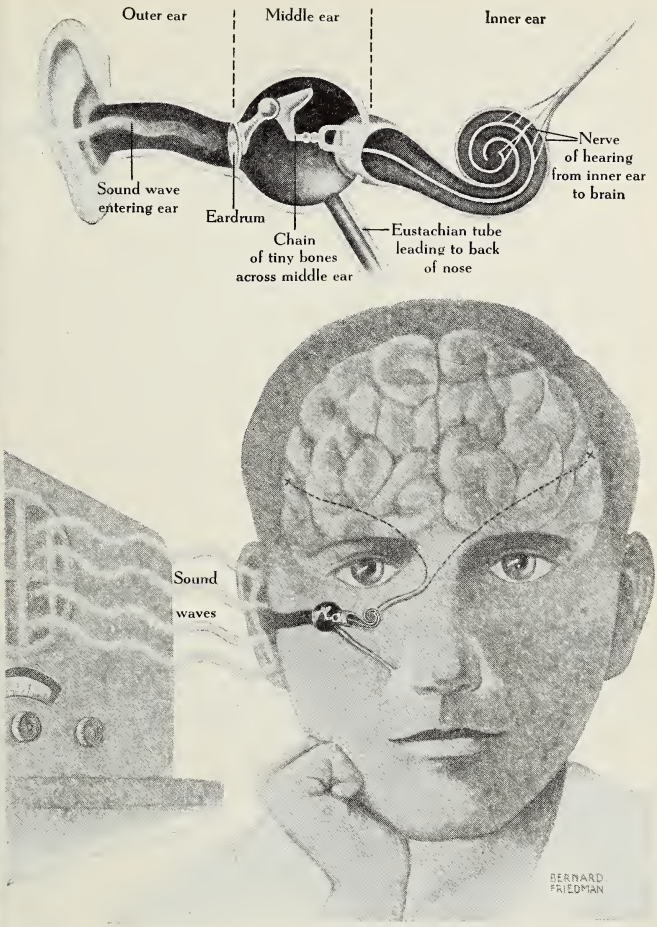
You do not need to worry about getting enough vitamin B if you drink a glass of milk with each meal and each day eat some bread and cereal which contain the outer coating of the grain. Usually this kind of bread and cereal is brown or dark in color. The color comes from the outer coating of the grain, which is called bran.

GUARDING THE SENSE OF HEARING

Place your hands tightly over your ears. Do the voices of people sound dim and far away? The outer part of the ear is only an open door through which sound travels to the part of the ear which makes it possible for you to hear. By covering your ears you close the door to sound. You may do this in fun or to keep from hearing something you do not wish to hear. But how should you like to live always in a world of dim sounds? The sense of hearing may be dulled when something goes wrong in the part of the ear which is buried deep in the skull to keep it safe. When this happens, all the sounds you love to hear seem dim and far away as they do when you cover your ears with your hands.

What the Ear Is Like

The part of the ear you see and wash is called the outer ear. A winding passageway leads inward from the outer ear. Across the lower end of this passageway is stretched a thin skin called a membrane. This membrane is the eardrum. Sounds are vibrations, or waves, in the air. Sound waves beating against the eardrum make it vibrate, or move back and forth. On the other side of the eardrum lies a small space called the middle ear.



Use this diagram as a guide while reading about the way in which sound messages are sent to the brain

A chain of tiny bones stretches across the middle ear to another space called the inner ear. The inner ear is filled with fluid. The movements of the eardrum, when sound waves strike it, make the chain of little bones move, and the movements of the little bones set the fluid in the inner ear in motion. The nerve of hearing is located in the inner ear. The movement of the fluid in the inner ear makes the nerve of hearing send sound messages to the brain.

The middle ear is connected with the throat by a short narrow tube called the Eustachian tube. This tube ends near the throat opening of the nose and close to the tonsils and the adenoid. Through this tube infection may enter the middle ear from the nose and throat. As the passage leading from the outer ear to the middle ear is closed by the eardrum, the Eustachian tube is the only open pathway leading to the middle ear from the outside world. Its purpose is to let air into the middle ear.

"

Have you had your hearing tested by means of an audiometer?

Galloway

Taking Care of Your Ears

The common cold is one of the greatest enemies of good hearing. Have you noticed that you cannot hear so well when you have a cold? One cold after another or a long-continued cold may lead to permanent loss of hearing. Sometimes tonsils or the adenoid which are enlarged or diseased cause loss of hearing. This is one of the reasons why a doctor may advise having them removed.

If you blow your nose too hard, infected mucus may be forced through the Eustachian tube into your middle ear, and may set up an infection. The pus in an infected ear may press on the eardrum. This makes the ear ache. Sometimes the eardrum breaks and the pus runs out through the outer ear. When your ear aches, you should ask your parents to take you to the doctor at once. The doctor may be able to prevent serious ear trouble.

Sometimes a person loses hearing so slowly that a long time goes by before he notices that he cannot hear so well as he once did. Boys and girls may appear to be dull and stupid simply because they cannot hear well. Many schools use an audiometer to test the children's hearing each year. Children who are found to have even a slight loss of hearing are then examined by a doctor. The doctor may be able to prevent further loss of hearing.

GUARDING THE SENSE OF SEEING

Place your hands over your eyes. Can you imagine how much you would miss knowing about the outside world if you could not see? Try to think of the things that give you pleasure just by your looking at them. Smiling faces, pictures, flowers, trees, clouds, sunsets, birds; do you like to

Steven A. Coons

Closing the door to sight

look at these things? Think of what you learn through your eyes. Think of the games you play and the things you do that require eyesight. Your eyes work for you in one way or another from the moment they open in the morning until they close in sleep.

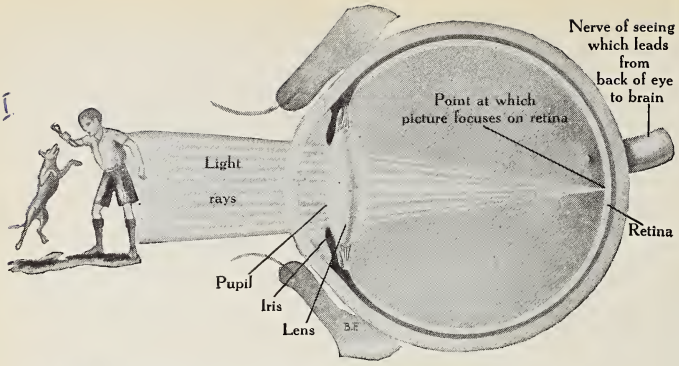
What the Eye Is Like

The eye is shaped like a ball. Only the front curve of the eyeball shows. The rest lies securely protected from injury in a deep socket in the skull.

Have you ever noticed how often and how quickly you turn your eyes? Each eyeball has six muscles which hold it in place. These muscles turn the eyeball upward, downward, outward, and inward. The two eyes turn evenly together. When the muscles of the eyes do not work together evenly, the eyes will be crossed, or turned in or out.

The round colored part of your eye is called the iris. In the middle of the iris is a round opening called the pupil, through which light enters the eye. The work of the iris is to make the pupil larger or smaller in order to let more or less light into the eye.

Right behind the pupil is the lens. The lens is crystal clear and elastic. It gathers up the light rays reflected from objects, and focuses these rays on a film at the back of the eye called the retina. *To focus* means "to bend rays of light so that they fall directly on one spot." In order to focus on the retina light rays from objects twenty feet or more away, the lens is flattened. But in order to focus light rays from near-by objects, tiny muscles surrounding the lens must make it round. The amount of work we give these muscles to do each day depends upon the length of time we use our eyes in looking at near-by things. The light rays reflected from an object make a picture of the object on



Use this diagram as a guide while reading about the eye and how it works

the retina. Nerves, spread out in the retina, send messages to the brain about this picture. The brain interprets the message so that the picture has meaning for us. We really see with the brain.

Taking Care of the Eyes

Giving the eyes a good light to see by is one of the most important things you can do to protect your eyesight. When you read or sew or study at home, sit near the best light in the room. The light should shine directly on your work from a lamp placed above the level of your eyes.

In order to look at near-by objects and see them clearly the muscles surrounding the lens of the eye must work to round up the lens. These muscles can work most easily if the book or work is held from fourteen to sixteen inches from the eyes. It is a mistake to keep on reading or doing other close work when the eyes feel tired. To look off into the distance now and then is a good way to rest the eyes,

as the muscles surrounding the lens do not need to work when you look at distant objects.

It sometimes happens that a person's eyes have not exactly the correct shape. The eyeballs may be too long from front to back or too short from front to back or the front curve of the eyes may not be regular. People whose eyes have not exactly the right shape may need to wear glasses. If you cannot read writing on the blackboard clearly from your seat or if the print in a book looks dim and wavy, you should have your eyes examined by an eye specialist. Other signs which show that you may be straining your eyes are frequent headaches or eye aches, watery eyes, soreness or itching of the eyes or lids, dizziness, and tired feelings on using the eyes. School children may have eye trouble without knowing it. This is why eye tests are given every year in many schools. Boys and girls who appear to be dunces in school may surprise everybody by making rapid progress as soon as their eyes are fitted with the proper glasses.

A person who wears glasses should go back to his eye specialist from time to time for an eye test. Sometimes the eyes change and different lenses are needed. Sometimes an eye specialist finds that a person no longer needs to wear glasses or that some other treatment is needed.

Guarding against Eye Diseases

Certain eye diseases are caused by germs. The eyes become red and sore and painful. Sometimes pus runs from them. Pinkeye is an infection of this kind. To escape eye diseases caused by germs it is necessary to form the habit of using only your own washcloth and towel and to keep your fingers away from your eyes.

General Electric Company

This picture shows the light placed correctly in relation to the work the girl is doing

Scientists have known for a long time that a lack of vitamin A causes a certain eye disease. In this disease the tears stop flowing and the eyeball becomes very dry. Germs begin to grow in the eyes, and the eyelids become sore, red, and swollen. Closely connected with this disease is another form of eye trouble called night blindness. People who have this trouble cannot see objects clearly in a dim light. It is possible to suffer from night blindness and not know it. People with night blindness who drive cars may be responsible for automobile accidents.

Night blindness is caused by a lack of vitamin A. In the eye there is a substance called visual purple. This substance helps the eye to see in dim lights. Light bleaches, or takes the color out of, visual purple. But this color is put back with the help of vitamin A. If vitamin A is not present in the body, the visual purple cannot be put back, and night blindness results. It is now possible to find out whether or not a person is getting enough vitamin A by having him look into an instrument which tells how fast his visual purple is being put back. If the rate is too low, he is not getting enough vitamin A. You will get the amount

"

In this picture the relation of the light to the work the girl is doing is incorrect

General Electric Company

of vitamin A your body needs if each day you have a quart of whole milk, some butter, and one or two helpings of a green or yellow vegetable. Fish-liver oil is especially rich in vitamin A. A person who is not getting enough of this vitamin is usually advised to take fish-liver oil in some form.

"

The instrument into which this girl is looking measures the speed with which her visual purple is being put back. If the rate is low, what vitamin ought she to have more of?

Frober-Faybor Company

Close your eyes and try to examine something with your fingers. What do you find out about the object from touch alone? Can you answer these questions about it? Is it rough or smooth? Is it hot, cold, warm, or cool? Is it flat, round, or sharp-cornered? If you were blind, could you recognize the object by touch? Touch sense organs are dotted all over the skin. We use them to learn about the temperature and movement of the surrounding air. We use them to tell us what objects feel like. People who are blind use them also to find out the shape and size of objects and where different objects are located.

Stick out your tongue and look at it in a mirror. Do you see the little papillae, or knobs, with which it is covered? At the back of the tongue the knobs are bigger. On the sides of all these knobs are the special cells which receive and send to the brain information about the taste of food. The four tastes are sweet, sour, salt, and bitter. Each taste cell can tell you about one kind of taste only. The cells at the back of the tongue are the bitter tasters; the cells at the edges are the sour tasters; the cells on the tip of the tongue are the sweet tasters. The salt tasters alone are scattered all over the surface of the tongue.

Has the smell of something good to eat ever made your mouth "water"? Does food lose most of its taste when you have a cold in the head? When the nose is stuffed up because of a cold you can tell apart only sweet, sour, salt, and bitter. But when your nose is clear, almost every food you eat seems to have a different flavor. The flavor of a chocolate peppermint, for example, is entirely different from the taste of a lump of sugar. And yet the tongue tells you only about the sweet taste of the candy. The chocolate flavor and the peppermint flavor are really smells. The

peculiar flavor of almost everything you eat is due to showers of tiny particles given off by the food. These particles pass up into the nose. The organs of smell in the nose send information about the flavor to your brain.

Training Your Taste

The organs of taste and smell play an important part in digestion because they make possible the enjoyment of food. Food that is pleasant to the taste helps to start the flow of saliva in the mouth and the flow of gastric juice in the stomach. A tasteless food or a food which you do not like may hinder the flow of these juices. A liking for different kinds of foods is largely a matter of habit. People usually like the foods which they are used to eating. People in the South Sea Islands, for example, eat raw fish and like it because they are used to it. Eskimo boys and girls would probably rather have a drink of whale blubber oil than a chocolate ice-cream soda. The boys and girls in Mexico like food highly seasoned with red pepper because they have eaten it from the time they were little children.

In every country of the world, the boys and girls like to eat the things they are used to eating. You can train yourself to like good foods that you do not like now by eating them whenever they are served to you. You can keep from forming a taste for things that are bad for you by never eating them.

Usually it is necessary to learn to like the taste of beer or wine or whisky. It may be necessary to learn to enjoy smoking. Why learn to like things that may be harmful? It is much better to learn to like the foods that will help you to have strong muscles and healthy nerves.

"hat is the sense of touch alone telling this boy about a banana?

Steven A. Coons

Alcoholic beverages are especially harmful to the nervous system. Alcohol interferes with the sending of messages from the brain to the muscles. A man who has had a few drinks may think he is doing something in a skillful manner, but actually he is very clumsy. His brain mixes up the orders which go out to the muscles. This is why so many automobile accidents are caused by people who have been drinking alcoholic beverages.

If you have ever seen a drunken man, you know that he acts as if his legs did not belong to him. He cannot make his legs take him where he wants to go. He may stagger out into the road in front of a passing car. A drunken driver cannot steer the car in a straight line. He does not know this. Indeed he has the feeling that he is king of the highway. He takes all sorts of foolish chances. As a result the car he is driving may run over someone or run into another car.

As alcohol dulls the brain, the drinker forgets his worries for a time and feels that he is a very fine fellow. Thus heavy drinking may become a habit. But turning one's back on troubles does not make them fly away. The only way to deal with problems successfully is to meet them face to face with sharpened wits.

© William LaVarre from Gendreau

This brother and sister of the Guiana tribe of Brazil are sharing a flat cake of cassava bread made of ground roots. Do you suppose you should like it as well as you like the bread you are used to eating?

ARE YOU DOING YOUR BEST TO FORM GOOD HEALTH HABITS?

Do you use the knowledge you have gained about food, sleep, exercise, fresh air, and sunshine to guide your actions?

Do you try hard to be cheerful, kind, courteous, and helpful even when things go wrong?

Are you forming the habit of thinking out ways to overcome your difficulties instead of doing nothing except worry about them?

Do you do everything you can to keep from catching cold?

Do you blow your nose gently?

Do you place your chair so that the light comes from above when you read or do other close work?

Do you look off into the distance now and then when you are busy reading or writing or doing other close work?

Have you had your eyes examined this year?

Is it necessary for you to wear glasses to see well? If so, do you keep your glasses clean?

Do you use only your own washcloth and towel?

Have you formed the habit of keeping your fingers away from your eyes?

Are you learning to like good foods that you once disliked?

Do you eat each day foods that are rich in vitamins A and B?

1. Complete the following sentences by supplying the missing word or words. (*Do not write in the book.*)

a. The nervous system is made up of the __?__, the __?__ __?__, and the __?__.

b. The __?__ and the __?__ __?__ make up the central nervous system.

c. The central nervous system receives information about the outside world from the __?__ __?__.

d. The action of the muscles is guided by the __?__ or the __?__ __?__.

e. Messages are carried to and from the central nervous system by the __?__.

f. __?__ are formed by doing a certain thing over and over again.

2. Choose the best ending for each of the following sentences. (*Do not write in the book.*)

a. The vitamin that prevents a nerve disease called beriberi is · (1) vitamin A · (2) vitamin D · (3) vitamin B.

b. The foods richest in vitamin B are · (1) white bread and white rice · (2) whole-grain breads and cereals · (3) meat and potatoes.

c. The nerve which carries sound messages to the brain is located in · (1) the inner ear · (2) the outer ear · (3) the middle ear.

d. Infection may enter the ear through · (1) the outer-ear canal · (2) the Eustachian tube · 3 the eardrum.

e. Light enters the inside of the eye through · (1) the pupil (2) the iris · (3) the eyelashes.

f. Light rays are focused on the retina by · (1) the muscles that turn the eyeball · (2) the lens · (3) the pupil.

g. When it is necessary to read or do other close work for a long time it is best to · (1) keep working steadily in order to finish sooner · (2) rest the eyes now and then by looking off into the distance · (3) rub the eyes to bring more blood to them.

h. Vitamin A, which is necessary for healthy eyes, may be obtained chiefly from · (1) milk, butter, and green and yellow vegetables · (2) white potatoes and gravy · (3) candy, cookies, and pie.

i. The flavor of food is learned from · (1) taste alone (2) smell alone · (3) taste and smell together.

j. We can learn to like good foods that we now dislike by (1) eating them whenever they are served · (2) eating them only when we feel like it · (3) eating them only when they are cooked in a certain way.

k. Good athletes do not drink alcoholic beverages because drinks containing alcohol · (1) taste bitter · (2) make it impossible for the brain and muscles to work well together · (3) are expensive.

THINK ABOUT THESE QUESTIONS

How does a person become skillful and kind and cheerful and courteous and eager to help other people? Are some people naturally kind and helpful or does it take practice to form good habits of mind? When you are asked to do things, do you practice being prompt and cheerful? Why is a person more likely to succeed in life if he gains good habits of mind by developing these habits when he is young? Why will he be better able to work with other people if he starts now to be the sort of person that most people like? Do you know now what you should like to do when you grow up? What are the habits of mind you will need in this occupation? Can you start now forming the habits that will make you a good doctor, or lawyer, or teacher, or nurse, or engineer, or businessman, or private secretary?

DO THESE THINGS

1. Write down everything you had to eat yesterday. Which foods are rich in vitamin B? Which ones are rich

in vitamin A? Can you plan meals for one day which will give you a larger supply of these vitamins than you had yesterday?

2. Make a map of the United States or Canada, and on it show the principal grain-growing regions. What is your favorite whole-grain cereal? Which parts of the country lead in the growing of this cereal?

3. Read the story of Helen Keller. How does she learn about the outside world? Does she learn about many things through her fingers that we learn through our eyes and ears? What habits of mind did Helen Keller learn when she was a little girl? How did these help her to overcome her handicaps and make it possible for her to become the great person she now is?

4. Make a list of all the different sounds that you like to hear. Make another list of the things you can do to take care of your ears so that you may always hear these sounds clearly. Talk the lists over in class.

5. The whole class may make a study of the classroom lighting arrangements. Has the light in different parts of the room been tested? If not, a committee of the class may borrow an instrument from the electric light company to measure the light. Do all the pupils in the room get an equal amount of light? Is it necessary to use artificial light for all or part of the day? Is the blackboard protected from glare?

6. Blindfold yourself before eating lunch or dinner, and pinch your nostrils together with your fingers. Then have someone place a piece of food on your tongue. Do not chew or swallow it. Can you guess what the food is? Then chew the food. Are you able to guess what the food is by the feel of it in your mouth? Do the touch organs in the mouth also give us information about certain foods?

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

spinal cord	Eustachian tube	night blindness
sense organ	vibrate	visual purple
central nervous system	audiometer	bleach
self-reliant	iris	papillae
attitude	pupil	blubber
beriberi	lens	handicap
steward	retina	perform
crystal	interpret	natural
constipation	eye specialist	particle

2. From the list above select a word or term described by each one of the following groups of words:

a habit of mind which determines the way a person acts
a person who manages something for others
a clear glassy substance
a state brought about when the bowels do not move regularly
an instrument used to test hearing
the round colored part of the eye
the part of the eye on which light rays make a picture
a substance in the eye which makes it possible to see in dim light
to take the color out
the layer of fat beneath the skin of a whale
a person who has made a special study of the eyes
little knobs on the tongue which give us the sense of taste

UNIT VIII

Early to Bed

Lucy and Dick had a new baby brother named Tim. Tim weighed seven pounds when he was born. He slept almost all the time. He was awake only when his mother fed him and when he was having his soap-and-water bath and his sun bath and his kicking time.

Lucy and Dick were weighed in school the day Tim was six months old. They brought their weight-record cards home. They showed the cards to their father and mother that evening.

"Look, Mother," said Lucy. "I've gained two pounds in the last three months. I weigh four pounds more than I weighed six months ago."

"And I weigh three pounds more," said Dick.

"That's fine," said Mother. "I'm glad you're growing so well. You know Tim is six months old today. Can you guess how many pounds Tim has gained in six months?"

"Three," guessed Dick.

"Four," guessed Lucy.

"Wrong," said Mother. "Tim weighs twice as much as he weighed when he was born. He has gained seven pounds in the last six months."

"Dick, suppose you had doubled your weight in the last six months," said Father. "How much would you weigh now?"

Dick looked at his weight-record card. "Why, I'd weigh a hundred and forty pounds," he said.

"That's just what I weigh," said Mother. "I've weighed about a hundred and forty pounds for a long time."

"Then you aren't growing bigger at all, are you, Mother?" said Lucy.

"No, I stopped growing in size before you and Dick were born," said Mother.

"So did I," said Father. "I have put on a few extra pounds, but I haven't grown any taller since I was twenty-one years old."

"Tim must grow in his sleep," said Lucy. "He doesn't do anything much except sleep."

"You grow in your sleep, too," said Father. "That's why you go to bed before your mother and I do."

Mother looked at the clock. Lucy saw her do it.

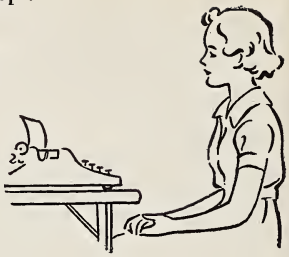
"Come on, Dick," said Lucy. "It's time for us to grow."

How much do you weigh? How tall are you? How fast are you growing? Ask your parents how much they weigh and how tall they are. Are they growing as fast as you are or have they stopped growing in size? How many pounds in weight and how many inches in height must you gain before you are as tall and as heavy as your father or mother? You gain in weight and height mostly while you are asleep. While you are growing, you need more sleep than people whose growing time is over. Sleep makes a great difference in your ability to use food to grow on. A boy or girl of your age needs between ten and eleven hours of sleep every night.

DO YOU KNOW

Why you grow mostly in your sleep?

How sleep cures you of tiredness?



Why some employers allow their employees to stop working for a few minutes at certain times during the day?

Whether resting your muscles also rests your brain?

What it means to relax?

Why people once thought night air was dangerous?

How to plan a good night's rest?

What to do during your leisure time?

When you are active, as you are during most of your waking hours, your body cells also are active. The heart and the breathing muscles are working hard in order to fill the demands for fuel food and oxygen sent out by the working cells. The muscles are busy using fuel food and oxygen to supply you with the energy to work and play. While all this activity is going on, the division of cells to make new cells and the mending of worn-out cells must be put off until the energy needs of the body are not so great.

When you are asleep, all your body activities slow down. Your heart pumps $33\frac{1}{3}$ per cent less blood than it does when you are awake. You breathe more slowly. The muscles fastened to your bones work only when you change from one position to another. Your body produces only half as much heat as it does when you are awake. In sleep broken-down cells are repaired, and new cells are produced by cell division. New cells are used to take the place of old cells which are completely worn out and, little by little, to add inches to your height and pounds to your weight.

Giving the Brain a Rest

While you are awake, your brain and your nerves are always working. You may rest your muscles by sitting in a chair when you are tired. But your brain never gets complete rest except in sleep. Try it some time and see. Choose the quietest place you can find. Relax all your muscles. Relaxing means that you "let go" of your muscles. Relaxed muscles feel soft and loose instead of tight and hard. As you sit with your muscles relaxed, a door may slam far off in the distance. Your brain tells you about

the noise. You use your brain to wonder who slammed the door. Sounds, odors, air movements, all the stir of life in the outside world, make your brain work even when your muscles are resting. This work is enormously increased when you think. You may not move a muscle while you are studying hard, but think how hard your brain is working. It becomes very tired if you keep it working too long without rest. You rest your brain only during sleep.

As bedtime draws near, do you begin to feel sleepy? Do you find it hard to keep your eyes open? Do the voices of people talking sound far away? Is it hard for you to keep your mind on what you are doing? Are you glad to go to bed? As you lie in bed, do outside noises sound dimmer and dimmer? Do the pictures in your mind become shadowy? At last you fall asleep. For hours you neither hear, nor see, nor feel, nor smell, nor taste. You have "lost your senses." In the morning you are able to see and to hear and to think better because your brain has had a rest. For ten long hours it has not had to pay attention to messages from the outside world.

The Healing Power of Sleep

When the body is very busy, waste products are continually being collected from the cells by the blood. The body gets rid of these waste products through the lungs and the kidneys as fast as it can even while it is working. But sometimes waste substances are produced faster than they can be removed. They pile up in the blood and are carried to all parts of the nervous system. These substances act as poisons on the delicate nerve tissues. This is why you feel so tired after working or playing too hard or too long. During sleep the body has a chance to free itself completely of the wastes that cause fatigue, or tiredness.

Steven A. Coons

Are you glad to stop what you are doing
and go to bed when bedtime comes?

The nerve cells also become tired when they have used up all their stored food. During sleep fresh supplies of food are carried to the nerve cells. Then the cells, worn out after their hard day's work, are made over "as good as new."

HOW MUCH SLEEP DO YOU NEED?

The principal thing we know about sleep is that we cannot get along without it. If dogs are kept awake for from ninety-six to one hundred and twenty hours, they die. People who have been kept awake too many hours may go to sleep standing up. One scientist studied a group of one hundred children who looked and acted tired all the time. It was found that these children had been having from one to three hours less sleep each night than another group of children who were alert, strong, and healthy. This scientist also found that children who did not have enough sleep had poor appetites, looked pale, and lost their tempers easily. They were often cross and naughty.

Does sleep make a difference in how you feel? Have you ever noticed that lack of sleep makes you feel cross? Can you study and play games better after a good night's sleep than after a night when you did not sleep well or sleep enough? You may hear people say that they do not need much sleep. Loss of sleep may not seem to make a great deal of difference to you. Very often boys and girls who stay up beyond their regular bedtime two or three nights a week do not connect the way they feel with too little sleep. They blame other people for doing things to make them cross. They think the teacher is making their lessons too hard. If their appetites are poor, they complain that their mothers do not give them the sort of food they like.

When you have your full growth, you will be able to decide for yourself just how much sleep you need to make you feel cheerful and rested at the beginning of a new day. But now, while you are growing up, it is best to take the word of the scientists who have proved by experiment that a boy or girl of your age needs at least ten hours of sleep each night in order to grow properly and to do good work.

PLANNING A GOOD NIGHT'S REST

It is just as important to sleep well as it is to sleep enough. Do you go to sleep five minutes after you lay your head on the pillow? Do you wake up at a certain time each morning feeling alert and rested? You can train yourself to be your own alarm clock. If you go to bed always at the same time and get up always at the same time, your body becomes used to going to sleep and waking up at these hours. What time must you go to bed each night in order to get at least ten hours of sleep before morning? When you have fixed the time, make this your bedtime hour.

How do you know it is bedtime? Do you keep watch of the time yourself or does your father or mother have to tell you it is time to go to bed? Which plan of keeping track of the time to go to bed do you think is the better? Do you like to feel responsible for doing the things you are able to do yourself? You can make yourself responsible for going to bed on time each night.

Slowing Down before Bedtime

Give yourself about half an hour before bedtime to slow down and prepare for sleep. What does a train do when it is approaching a station where it must stop? Suppose

the engineer kept the engine going full speed ahead. Would he be able to stop the train at the station? In sleep your body comes as close to a full stop as it can and yet remain alive. The body cannot pull into the station of sleep immediately after hard exercise or study or excitement of any kind. It must slow down first. If it does not have a chance to slow down before you get into bed, it must slow down afterward. Reading an enjoyable book that is not exciting, playing a quiet game, and talking about pleasant things are good ways of passing the last half-hour before bedtime.

Sometimes it is hardest to get to sleep at the very times when we need sleep most. These are the times when we are worried or fearful about something. The mind is kept busily at work trying to think out the answer to some puzzling problem. It is well always to remember that a rested brain refreshed by sleep is far better able to deal with problems than a tired brain.

Try to make your mind as blank as a sheet of blank paper when you are settled in bed. If you cannot do this, at least think of pleasant things. Think of doing something or having something that would make you happy. One little girl wanted a pink parasol very much. Whenever she could not sleep, she said to an older sister, "What shall I think about?" The sister said to her, "Think about a pink parasol." Thinking about a pink parasol and enjoying it in imagination always put the little girl to sleep. In later years, when she was old enough to earn money, she bought a pink parasol with the first money she earned.

Thoughts of this kind are called daydreams. Some people daydream too much. They get all their pleasure from the dreams and do not try to make their dreams come true. But most people who have done great things have first dreamed about doing them. Without restful sleep it is very hard to make dreams come true.

Steven A. Coons

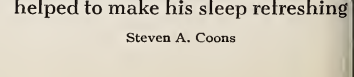
Quiet games help the body to slow down before bedtime

Restful Sleep

To have restful sleep your body must be comfortable. If you are too hot or too cold, or the air in the room is warm and stuffy, or the bedclothes are wrinkled, or a light shines in your eyes, your brain is kept busy answering "trouble calls." Even if you doze off, you twist and turn and perhaps have troubled dreams because your brain is only half asleep. This kind of sleep is called restless sleep. It means that you are not really resting because your brain and your muscles are still at work.

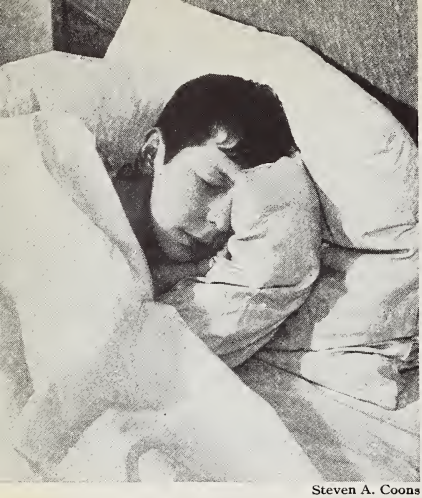
Light and noise are the chief enemies of restful sleep. The bedrooms should be the quietest rooms in the house. Night noises in cities are especially troublesome. In some cities laws have been passed which forbid the blowing of automobile horns after a certain hour. Milk wagons which make their rounds in the early morning must be fitted with rubber tires. People who live in apartment houses and hotels are asked to turn their radios low in the latter part of the evening and to shut them off completely after a certain hour. People are requested not to talk or laugh loudly in the streets and in the halls of buildings used as dwellings when most of the other people have gone to bed.

What is your community doing to stop unnecessary night noises? What are you doing to help? Do you try not to disturb little children and older people who are taking afternoon naps when you come home from school? If you come home late from a party, do you walk on tiptoe, talk in whispers, and close doors gently? Are you quiet early in the morning when other people are still sleeping? Boys and girls who are careful not to disturb the sleep of others show that they have good manners.



Almost time to wake up after a good night's sleep. What did this boy do before he went to bed which helped to make his sleep refreshing

Steven A. Coons



Steven A. Coons

First, this boy tried sleeping with his head on two pillows. Does he look comfortable?

It is hard to go to sleep when light shines directly into a bedroom. Window shades may be used to darken a room when light streams in from street lamps or from buildings near by. In the summer when the shades might shut out refreshing breezes, a floor screen may be placed about two feet from the window. Any boy or girl who is handy with tools can make such a screen. Another way to shut out light is to tie a piece of dark material loosely over the eyes.

Sleep in a warm stuffy room will not be refreshing. In the wintertime the heat should be turned off before you get into bed. Open at least one window, top and bottom. However, be careful not to let wind blow directly on your head, as this may cause you to be chilled. Test the air movements in your bedroom when a window is open top and bottom. You can do this by using strips of tissue paper which move in a slight breeze. Place your bed in the part of the room where the movement of air is least strong. A board placed in the lower part of the window helps to keep air from blowing directly on the people in a room. Floor screens may be used instead, or a sheet or blanket hung over two chairs.

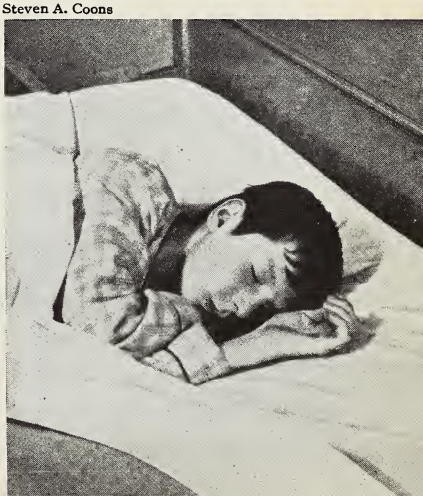
People used to sleep with their windows closed because they thought that night air gave them chills and fever. We know now that a certain kind of mosquito carries the illness

that people once blamed on night air. This illness is malaria. Its name comes from two Italian words which mean "bad air." If you live in a place where malaria is common, make sure that your windows are tightly screened in the summer and fall. The screens will keep malarial and other mosquitoes out and let the cool night air in.

Even when your bedroom is dark and quiet and filled with fresh air, your sleep may not be restful if your bed is not comfortable. The mattress should be firm, but not so hard that it will not "give" when you move. In cold weather you should have enough blankets to keep you comfortably warm, but the blankets should be light in weight. You cannot sleep well if you are too cold or too warm or too heavily loaded with covers. In making the bed the bedclothes should be drawn smooth. However, do not tuck them in so tightly that you cannot move about freely in bed.

What position do you usually take when you first get into bed? Do you change this position before you fall asleep? The correct sleeping posture is lying relaxed on the back or on the side. It is just as important to lie flat in bed as it is to stand straight in the daytime. A big fat pillow makes it impossible for you to lie flat. If you feel that you must have a pillow, choose a small, flat one. Many boys and girls have trained themselves not to use any pillow at all.

Steven A. Coons



Now he sleeps with no pillows at all. His posture is better than it used to be. Why?

Getting Ready for Bed

What do you do to get ready for bed? No one sees you when you are in bed and the light has been turned off. You do not need to think about your looks as you do when you get ready for school. But if you give yourself plenty of time to get ready for bed, you can do many things that will help you to be better looking in the daytime. Here are some of the things you should do: Clean your teeth and wash your face, hands, neck, ears, feet, and armpits. Take off all your day clothes and put on night clothes. Hang up your clothes to air, and place your shoes where they will dry out thoroughly. A good place to air clothes is near an open window.

Before going to bed is a good time to clean and file the fingernails, to rub cold cream into the hands to prevent chapping, and to brush the hair to make it smooth and shining. Washing out socks or stockings, sewing on missing buttons, laying out fresh underwear ready for the morning, and polishing shoes are all things that boys and girls can do before bedtime if their mothers are too busy to do these things for them.

Some boys and girls find that they sleep better if they take a warm bath at bedtime. The bath should be taken slowly and without hard rubbing. A clean body, clean night clothes, and a bed made up with fresh crisp sheets all help you to relax.

Eating a heavy meal at night makes some boys and girls restless for a while after they have gone to bed. Coffee or tea with the evening meal keeps many grown-up people awake. These drinks contain a drug that makes the heart beat faster. As slowing down of the heartbeat takes place during sleep, a drug that speeds it up is likely to keep sleep away.

Have you ever found it hard to go to sleep at night after eating a big meal two or three hours before you went to bed? Boys and girls usually sleep better if they eat a light evening meal of easily digested food. By easily digested food is meant simple foods such as milk, soup, cereals, stewed fruits and fruit juices, and soft-boiled or poached eggs.

Some people find that their sleep is less likely to be disturbed if they do not drink water or other liquids after the evening meal. However, many boys and girls find that a drink of warm milk before going to bed helps them to relax and to go to sleep more quickly. This is a practice to try out for yourself.

Do you sleep alone? Sleep is more restful when you have a bed to yourself. Perhaps it is impossible for you to sleep alone now. If so, a bed all your own is one of the things you can plan to have some day when you begin to earn money.

BREAK OF DAY

If you have had enough sleep, you will feel like getting up when you wake up in the morning. Different people act differently when they first wake up. You will have to decide for yourself whether it is better for you to jump out of bed soon after you open your eyes or to wait for a little while until you become used to being awake. One boy has trained himself to wake up twenty minutes before he needs to get out of bed. He says he "likes to arrange his mind" before getting up. Other boys and girls do not like to stay in bed after they have waked up. They wish to get ready right away for the affairs of the day. Which kind of boy or girl are you?

As morning is a very busy time for both you and your mother, set an hour for getting up that will give you plenty of time to wash and brush your teeth and dress neatly. Allow time to eat your breakfast without hurrying and to go to the toilet afterward. It is pleasant to start the day with the feeling that you have time to do all the things you need to do to get ready for school. It is pleasant to feel that you have time really to "look at the day" when you leave the house.

Some people plan their time so badly that they always feel rushed. They are so busy making up for lost time that they do not even notice whether the sun is shining or not. They do not enjoy hearing the songs of the birds and the sounds of laughter or seeing all the funny and interesting things that go on about them. It is often said that the most successful people seem to have the most time. They have time to rest and to enjoy themselves and to help other people because they have learned how to plan their time wisely.

Daytime Rest

The body gets complete rest only during sleep. But short rests during the day will help to keep you from getting too tired. Many employers have found that more and better work is done in their factories or offices when the employees are allowed to stop working for a few minutes at certain times during the day. Take a little time out now and then through the day to let all your muscles go limp. Look off into the distance to rest your eyes. Plan enough time for your meals so that you will be able to rest after eating. If you spend a few minutes of every hour in relaxing, you will not feel ready to drop from tiredness when the day is over.

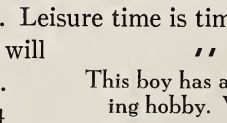
Stretching helps this girl to get used to being awake

Steven A. Coons

Many people find rest in a change of occupation, as different sets of muscles are used in different kinds of work or play. The brain too needs a change now and then. Have you ever heard of a person "going stale"? This means that body and mind have become tired of doing the same things day after day. A person who has "gone stale" may be freshened up again by new interests and a change of occupation.

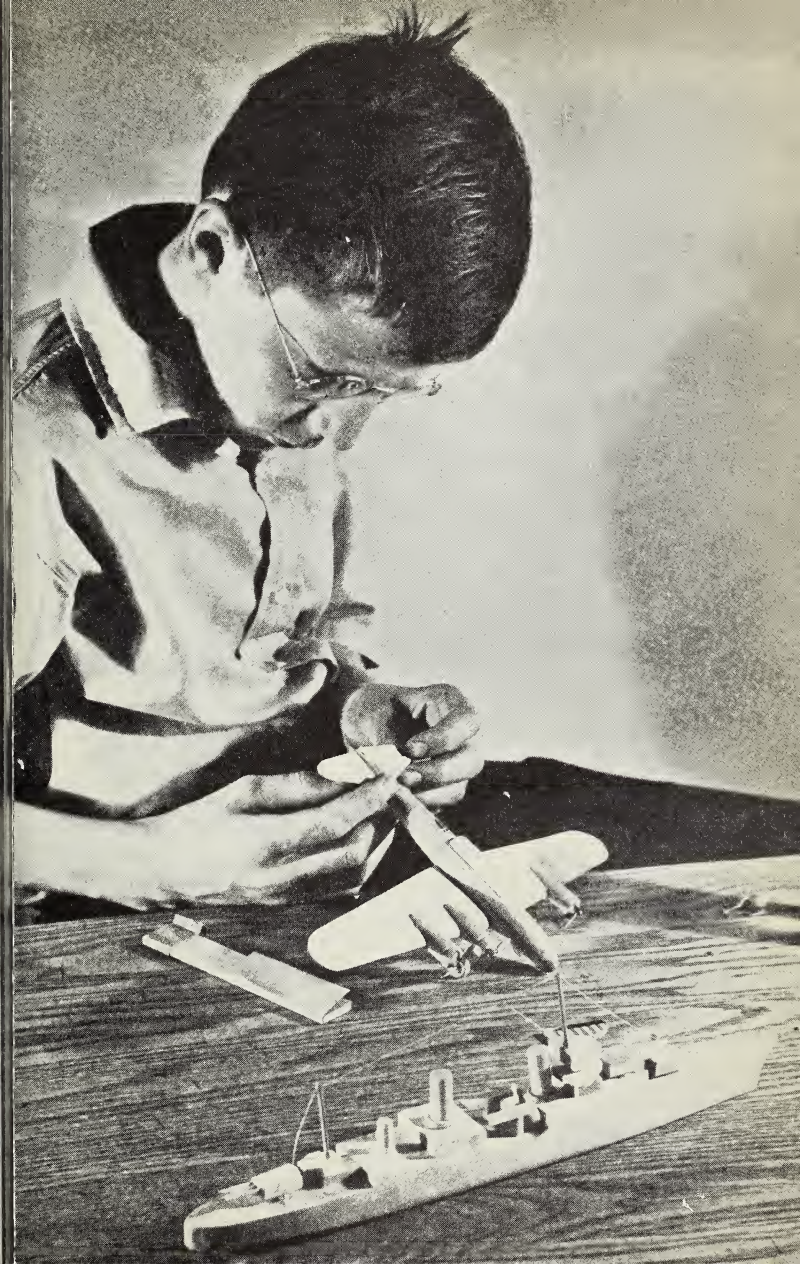
What do you like to do in your leisure time? This is the spare time you have left over from study and home duties and outdoor play. Have you a hobby? Many grown-up people find pleasure and relaxation in hobbies that they began to be interested in when they were boys and girls. One popular hobby is collecting certain things, such as stamps, pressed flowers, butterflies, coins, shells, pretty pebbles, and tiny dolls or china animals. Gardening, photography, and making toy models of various kinds are interesting hobbies. Some boys and girls find pleasure in playing a musical instrument or in listening to music. Others spend their leisure time in reading good books. Your leisure time is *your* time to do with as you please. Use it to do what *you* like best to do. It is your "one little corner in life" where you can show that you are different from everyone else.

Long ago a poet wrote that if a person has two loaves of bread he should sell one and buy white hyacinths for his soul. This means that it is necessary to have things that will give us pleasure as well as food and other things that we must have to stay alive. Pleasure helps to keep our minds healthy, and it is just as important to have a healthy mind as it is to have a healthy body. Leisure time is time to use in developing the interests that will give pleasure all through life.



This boy has an interesting hobby. What is yours

Steven A. Coons



ARE YOU DOING YOUR BEST TO GET AT LEAST TEN HOURS OF RESTFUL SLEEP EACH NIGHT?

Do you go to bed always at the same time each night?

Do you get up each morning in time to get ready for school without having to hurry?

Do you do what you can to make your bed as comfortable and as clean as possible?

Do you turn off the heat and open a window, top and bottom, before getting into bed?

Do you try to have pleasant thoughts before you go to bed?

Do you brush your teeth at bedtime?

If you do not take a warm bath at night, do you wash at least the parts of the body that get especially dirty or sweaty during the day?

Do you place your day clothes and your shoes where they will air out thoroughly before getting into bed?

Are you doing what you can to make your bedroom as quiet and as dark as possible?

Are you careful not to disturb the sleep of others?

Do you relax your muscles for a few minutes now and then in the daytime?

Do you try to slow down before going to bed?

Are you very much interested in something that is not connected with study or home duties or outdoor play?

1. Which of the following statements are true and which are false? Reword each false statement so as to make it true. (*Do not write in the book.*)

a. Grown-up people need more sleep than boys and girls do.
b. All the body activities slow down during sleep.
c. In sleep worn-out cells are repaired.
d. The brain rests only during sleep.
e. An eleven-year-old boy or girl needs about eight hours of sleep each night.
f. A regular bedtime helps a person to form the habit of going to sleep soon after getting into bed.
g. Hard study just before going to bed helps a schoolboy or a schoolgirl to fall asleep quickly.
h. Worry keeps people awake.
i. A boy or girl gets more rest by staying in bed until there is just enough time left to get to school by hurrying.
j. Bedrooms should be the quietest rooms in the house.
k. It is courteous and kind to take care not to disturb the sleep of others.
l. The body needs rest only at night.
m. A change of occupation is sometimes restful.

2. Which of the following practices will help you to get restful sleep? Which will interfere with sleep? Give a reason for each choice. (*Do not write in the book.*)

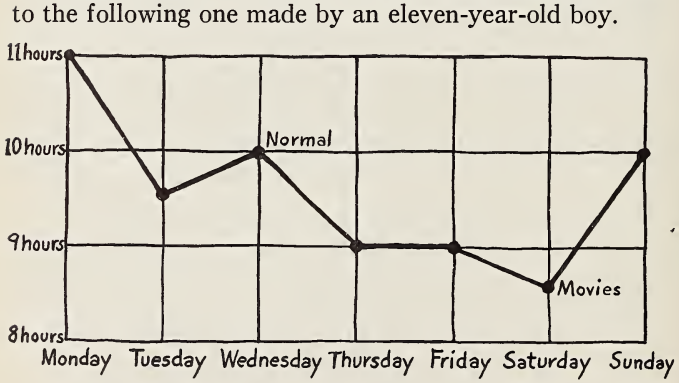
a. Keeping a light burning in the bedroom at night.
b. Having light warm blankets on the bed in cold weather.
c. Opening a window, top and bottom, before getting into bed.
d. Leaving the heat on all night.
e. Wearing daytime underwear as night clothes.
f. Drawing the undersheet tight in making a bed.
g. Having a large fat pillow.
h. Eating a light evening meal.
i. Playing exciting games just before bedtime.
j. Taking a warm bath slowly.

THINK ABOUT THESE QUESTIONS

Why is it harder for people to get enough sleep now than it was in the days before electricity was put to so many uses? What are some of the evening amusements you must give up in order to get to bed in time to have ten hours of sleep at night? Does a radio program that you like to listen to come on after your regular bedtime? Must you give up going to the motion pictures on school nights? Do you think it is worth while to plan to get enough sleep? Do you think good health is worth working for? What are some of the reasons for your answers?

DO THESE THINGS

1. Keep a record for one week of the hours of sleep you get each night. How does your record compare with the amount of sleep needed by a boy or girl of your age? How does it compare with the record of the other members of the class? Use your sleep record to make a graph similar to the following one made by an eleven-year-old boy.



2. Make a plan of the room in which you sleep. Show the location of the furniture, the doors, and the windows. Show the relation of the room to other rooms in the home.

If light shines into the room at night, show where it enters. Test the air movements in the room when the windows are open top and bottom by tying strips of tissue paper to the furniture. Show on your plan where the air movements are strongest. Can you think of ways in which you may overcome anything connected with your sleeping arrangements that is interfering with restful sleep?

3. Plan evening meals for one week, choosing foods that you like and that you digest easily. Milk, soup, fruit juice, cereals, bread and butter, baked potatoes, creamed vegetables, salads, soft-boiled or poached eggs, stewed fruits, custard, and gelatine are all good foods from which to choose a light evening meal.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words:

relax	doze	malaria
relaxation	alert	affair
fatigue		

2. Make sentences with words missing which can be completed by using words in the list above. Exchange your sentences with those of another pupil and try to complete the sentences he or she has made.

UNIT IX

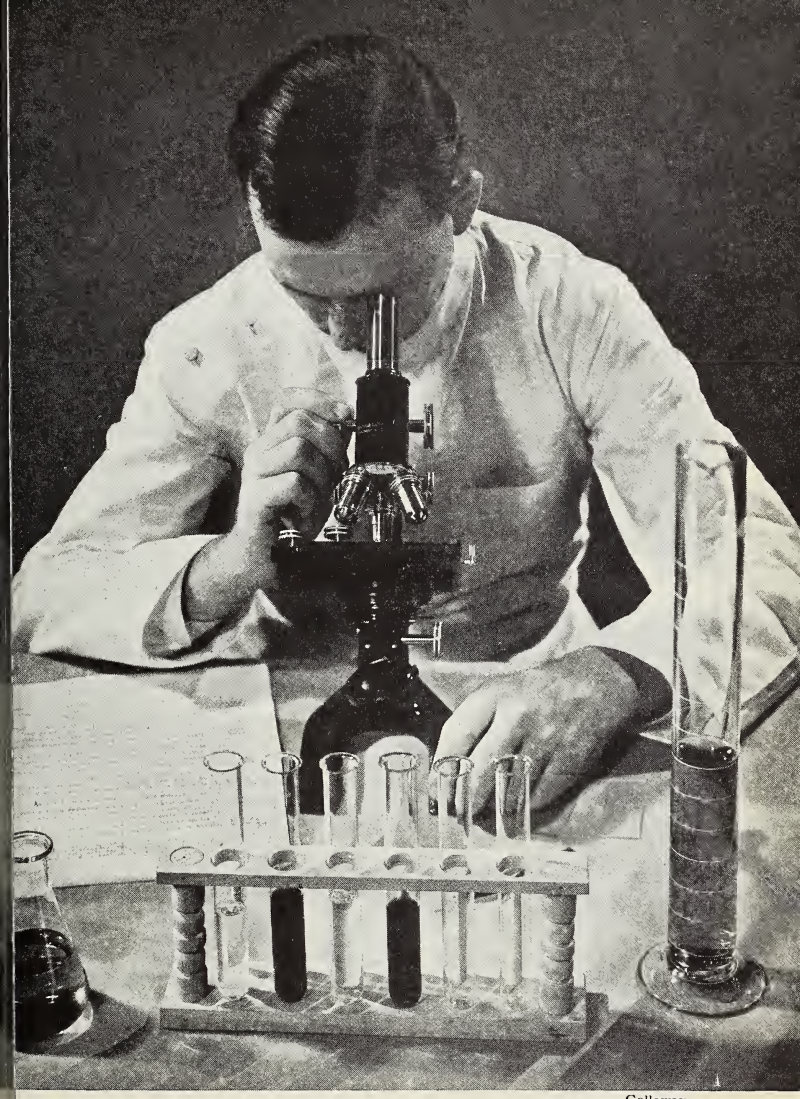
Helping the Body to Fight Disease

Even perfect eyes cannot see everything there is to be seen. Without the aid of a telescope our eyes cannot see the mountains of the moon, and yet the mountains are there. Without the help of a microscope our eyes cannot see germs, and yet there are germs all around us. There was once a time when people knew only about the things that could be seen with the unaided eye. They had no telescopes with which to bring the stars closer or microscopes with which to explore the world of the very small.

A little more than three hundred years ago a great scientist, named Galileo, made a telescope with which he could see the mountains of the moon and separate stars in the Milky Way. We do not know who invented the microscope. But in the year 1632 a Dutch boy was born who was to see things through a microscope that no one else before him had ever seen.

The name of this boy was Anton van Leeuwenhoek. His hobby was making microscopes and using them to look at all sorts of things. He made very careful descriptions and drawings of what he saw.

Van Leeuwenhoek kept making better and better microscopes until at last he had one which gave him a great surprise. One day in the year 1675 he peered at a drop of clear rain water and saw swarming in it "little animals." That was a great day, for the "little animals" were what we now call germs.



Galloway

A scientist using a microscope to explore the world of the very small

Van Leeuwenhoek was a great explorer. He was the first to explore the world of things too small to be seen by the eye alone. Two hundred years went by before people learned the greatness of his discovery. He himself could not know how great it was. Among his microscopes he lived a busy, happy life. He was ninety-one years old when he died. He left behind him a tool that he had found weak and made strong,—the microscope. Other men who came after him improved it still more. At last the microscope fell into the hands of men who used it to solve the great riddle of communicable diseases, that is, diseases which are catching.

People used to think that all children had to have measles and chicken pox and whooping cough. They thought that the sooner children had these diseases and were rid of them, the better. Parents feared diphtheria, scarlet fever, typhoid fever, and tuberculosis, but they did not know what to do to prevent them. Now we are no longer working in the dark. We know how to fight communicable diseases. By learning how to make the best use of this knowledge, boys and girls may avoid many of the diseases that sometimes keep people from making the most of themselves.

DO YOU KNOW

Why milk turns sour?

What is meant by fermentation?

How the discoveries made by Louis Pasteur help us to fight germs?

Whether there are any helpful germs?

Why an apple decays?

What makes the bubbles in a can of spoiled fruit?

What pasteurization means?

What happens when living germs get inside the body?

Why the wound made in an operation very seldom becomes infected?

How fire helps us to fight disease germs?

What ventilation means?

How vaccination got its name?

LEARNING ABOUT GERMS

As far back in your life as you can remember, you have probably heard people talk about germs. Have you been told so often to wash your hands before eating, to sneeze or cough only into your handkerchief, to keep away from people with colds, that you wish germs had never been discovered? Do you realize that kings would once have given a fortune in gold for the knowledge about germs that any eleven-year-old boy or girl has today?

Down to the days when your great-grandparents were young, people knew of nothing better to do than to run away when a dangerous communicable disease broke out in a city. Great and good and wise men spent their lives trying to learn what caused such diseases. At last one of them succeeded. His name was Louis Pasteur. He was born of poor parents in a little town in France in the year 1822. He died, loved and honored by the whole world, in 1895 in the city of Paris.

What Is Fermentation?

The question that started Pasteur on the road which led to his great discovery was this: Why does milk turn sour? In those days scientists knew that the souring of milk is a kind of fermentation, but they did not know what causes fermentation.

Probably you are familiar with other kinds of fermentation besides the souring of milk. Has your mother ever opened a can of fruit to find a foam of little bubbles at the top? Perhaps she said that the fruit had spoiled or had fermented.

Yeast causes fermentation. If you put a little yeast in a jar of sugar and warm water, after a while bubbles will

appear in the liquid. In making bread, yeast added to the dough makes little bubbles that cause the dough to rise.

Just one hundred years ago two scientists in France began to examine yeast under the microscope. Both men saw that yeast is made up of round cells, like tiny globes, that can multiply themselves. They do this by sending out buds which break off from the parent cells to form new ones. As only living things—that is, plants and animals —can multiply themselves, these scientists said that yeast is alive. It is really a tiny plant. Fermentation is caused by a living thing.

But other scientists said, "No! How can you say that fermentation is caused by something alive, such as yeast, when we see so many things fermenting, or spoiling, or turning sour where no yeast is present? Show us the yeast

"

"Look out! Where's your handkerchief?"

A. J. Iorio

One yeast cell multiplied into the number you see here in three hours. The picture was taken with the help of a microscope which makes the yeast cells look 1000 times bigger than they really are

"

that makes milk turn sour. Show us the yeast that makes meat and other solid foods spoil."

The battle between the scientists went on furiously until Pasteur began to study the souring of milk. He noticed that, when milk sours, little gray patches are formed on the sides and the bottom of the jar. Putting a little of this gray material under the lens of his microscope, he found that it was made up of tiny cells much smaller than the cells in ordinary yeast. He put a tiny bit of the gray material into another liquid where it could live, and lo! that liquid began to ferment. Pasteur called this gray material the ferment, or yeast, of milk.

You already know that the yeast used in making bread rise is a plant. Its nearest relatives are the molds, which you have probably seen on spoiled food. The ferment, or yeast, of milk is also a plant. It belongs to a family of tiny plants called bacteria. The bacteria in turn belong to a great group of tiny living things which you know by the name of germs.

The Harmless Bacteria

Most bacteria are harmless. The bacteria that make milk turn sour may do this when we do not want them to, but often this is a helpful change. There are many ways in

which we use sour milk. We use it to make cheese. Some people use it to make gingerbread and other good foods.

Have you ever seen a thick cloudy material in a bottle of vinegar? This is called the "mother" of vinegar. It contains thousands of tiny bacteria which change apple juice into vinegar.

Have you ever eaten sauerkraut? Does it taste anything like raw fresh cabbage? The sour taste of sauerkraut is caused by changes that take place in the cabbage when two kinds of bacteria start to work on it.

Do you know why an apple decays? Do you know why leaves lying on the damp ground start to rot? Certain bacteria cause decay in fruit and other foods and in the leaves, stems, and wood of all plants. The decay bacteria may not be harmful, but they are certainly annoying when they cause good food to spoil. The bacteria which turn plants into woodland and garden soil are very helpful, because this soil contains food that is necessary for the new plants growing in the soil. You have already learned that friendly bacteria in the soil, known as nitrogen-fixing bacteria, make it possible for plants to pass on to us nitrogen from the air in a form that our body cells can use.

All the changes brought about by bacteria in food and in soil and in the living or dead bodies of plants and animals are fermentations. There are many different kinds of fermentation. Pasteur proved that every kind of fermentation is caused by a special kind of living ferment.

Galloway

Bread rises because of the little bubbles that yeast makes in the dough

Alcoholic Fermentation

If yeast is added to a liquid containing sugar, this ferment eats the sugar just as you eat your food. It throws off waste just as your body throws off waste. The wastes thrown off when yeast eats the sugar in grape juice or sweet cider or crushed grain sprouts are alcohol and carbon dioxide. This kind of fermentation is called an alcoholic fermentation.

You have learned that carbon dioxide is a waste gas made when your body burns sugar. This waste is carried to your lungs by the blood and you get rid of it when you breathe out. The carbon dioxide formed when yeast eats the sugar in a liquid bubbles up through the liquid. This is why there is foam at the top of a can of spoiled fruit. It is the reason why wine sparkles and beer foams. Carbon dioxide gas is put into soda water to make it bubble.

The gas formed in a fermented liquid, such as beer or wine, is not harmful to the body, but the alcohol is. Grapes and grape juice, apples and sweet cider, and the cereal grains are all foods that people from the earliest periods of history until now have found to be delicious and healthful. When fruits and grains have fermented, most of their food value is gone. Your mother probably throws away a can of peaches or cherries that has fermented. There are no vitamins or minerals in wine and beer and whisky. The sugar has been eaten by the yeast. All that is left is water mixed with alcohol, and the alcohol is a poison that dulls the mind and makes a person do queer things which he would never do if he were sober. Fruit juices and cereals do the body good. Wine, beer, and whisky do the body harm. It is a great shame to turn something good into something harmful.

How Pasteur Cured "Sick" Wine

Grape juice is turned into wine because wild yeasts present on the grapeskins begin to eat the sugar in the grape juice when the grapes are crushed. Now it happened in Pasteur's day that certain wines got "sick," just as animals and human beings do. Some of the wines became bitter; some became very sour. What made the wines sick? Pasteur thought the sickness must be caused by other ferments in the wine besides yeast. How could he prove it?

He went to his old home in Arbois where he had lived when he was a little boy. This was a great grape-growing country. Some of Pasteur's boyhood friends had sick wines, and they were glad to have him study samples under his microscope. Pasteur had no sooner started his work than he proved that his idea about sick wines was a true one. Every time someone told him that a wine had a funny taste, he found strange ferments mixed with the yeast in the bottom of the wine barrel. Soon he was able to tell people that the wine would taste sour or bitter, according to the kind of ferment he found in it.

The next thing to do was to find a way to kill these ferments that spoiled wine. Pasteur found, after many tests, that he could kill the disease ferments, as he called them, by heating the wine to a certain temperature. The heating did not hurt the wine. This is how the name *pasteurization* came to be given to the heating of a liquid to a temperature high enough to kill any harmful ferments, or germs, that may be in it. Pasteurization is now used principally to kill any harmful germs that may be in milk. All milk used for drinking should be pasteurized. Do you drink only pasteurized milk? How can you tell whether the milk has been pasteurized?

After these studies, a question kept buzzing about in Pasteur's mind. This was the question: If a disease ferment can make a wine sick when it gets in the wine, why is it not possible that a disease ferment may make an animal or a person sick when it gets inside the body?

Do you see how important this question was? After long years of hard work Pasteur found the answer. What he proved was this. Each kind of communicable disease is caused by a special kind of living disease ferment, or germ, which enters the body from the outside. When living germs get inside a body where there is warmth and moisture and food, they start to grow and multiply. In eating and living they throw off poisons, just as yeast in eating the sugar in grape juice or sweet cider or crushed grain sprouts throws off the poison alcohol. These poisons are what make a person feel sick when he has a disease caused by germs. A communicable disease, such as smallpox or measles or diphtheria, is really a kind of fermentation with the disease germs acting as the ferments.

How a Doctor in Scotland Used Pasteur's Discovery

While Pasteur was studying fermentation in France, an eleven-year-old boy named James Greenlees was carried one day into a hospital in the city of Glasgow in far-away Scotland. He was suffering from a broken left leg caused by the wheel of a cart which had passed over it. The ends of the broken bone had pushed up through the skin. In those days many people died from injuries of this kind. Even though a doctor did his best to help the injured person to get well, the wound usually became infected. At

that time doctors did not know that an infection in a cut is caused by germs. Even simple operations, such as opening a boil or sewing up a cut hand, were very dangerous. The doctors did not know that germs on the patient's skin or on their own hands or on the tools with which they worked or on the bandages they used might cause a serious infection.

A kind-faced young doctor came to see James. His name was Joseph Lister. When he was working in the hospital, it had made him very sad to see the suffering that often followed the simplest operation. While studying infection in wounds, he came to believe that wound infection was something like the decay of meat and fruit and wood. But what caused decay? Then a friend advised him to read some of the things Louis Pasteur had written about decay as a kind of fermentation with harmful germs acting as the ferment. Could it be possible that harmful germs caused wound infections? If this was true, how could germs be kept out of a wound? Perhaps something might be found to kill the germs in the wound and on the hands and the tools of the doctors while they were operating on sick people.

Lister decided to use a liquid called carbolic acid. This liquid had already been used to disinfect body wastes in sewers. On August 12, in the year 1865, Lister used cloths dipped in carbolic acid to cover the wound on James's leg. To Lister's joy the wound healed without a sign of infection.

A liquid, such as carbolic acid, which kills germs, or makes them harmless, is called an antiseptic. Lister was the first doctor to use an antiseptic in performing an operation. He washed his hands and his tools in a solution, or mixture, of carbolic acid and water before operating, and he had a carbolic acid solution sprayed into the air while he was working. Doctors who perform operations are called surgeons, and the work they do is called surgery. Lister

is called the father of antiseptic surgery. He worked all his life to find better ways to prevent infection in wounds.

Nowadays the danger of infection after an operation has almost disappeared. In hospitals, where most operations are performed today, no germs are allowed to get into a wound. The patient's skin, the clothes and hands of the surgeons and nurses, the tools with which the surgeons work, and the bandages used to cover the wound are all made entirely free of germs.

But when the skin has been cut through in an accident, an antiseptic is needed. Probably the antiseptic you know best is iodine. It is very important to put an antiseptic on even a small break in the skin, such as a scratch or a broken blister. Blisters and cuts deeper than a scratch should then be covered with cloth that is free of germs. Such cloth is said to be sterile. You may buy in a drugstore a kind of sterile cloth which is called sterile gauze. Another way to make cloth sterile is to press it with a hot iron until it is slightly scorched or brown. Bad cuts should always be taken care of by a doctor. A doctor knows better than anyone else what to do to clean all the germs out of a cut and how to keep the wound clean.

KEEPING HARMFUL GERMS OUT OF THE BODY

Great heat destroys most germs. Heat is one of the best weapons we have in the fight against communicable disease. When foods are boiled or baked in the oven, any germs they may have contained are killed. When milk is pasteurized, harmful germs are destroyed. When water is boiled, any germs that may be in it are killed.

This girl has scratched her finger. How is she helping to guard against infection?

Steven A. Coons

The water in your home and school is pure, that is, free of germs. But the water in ponds, lakes, and streams may not be pure. Typhoid fever is the communicable disease most often spread by impure water. Once many people died of this disease. Now very few people get it because great care is taken to supply communities with pure water. The bacteria of typhoid fever leave the body of a person sick with it in wastes from the large intestine. A large body of water, such as a lake or river, or a small one, such as a spring or well, may contain typhoid germs that entered the water in body wastes. When you are on a camping trip or an automobile trip, boil all your drinking water unless you know it is free of germs. In many parts of the country springs that contain pure drinking water are marked "Pure" by the board of health.

Boiling or baking kills the germs on food, but germs may be put into the food after it has been cooked. This is why it is so important to wash your hands with soap and warm water before eating and never to cough or sneeze on food. Food also should be protected from dirt, dust, rats, mice, and flies and other insects. Never pick up and eat food that has fallen on the floor or exchange bites of an apple or candy or some other food.

Stay Away from Sick People

Have you ever seen a quarantine sign on a door which says "Measles" or "Scarlet fever" or "Diphtheria"? Such a sign means that your board of health is trying to protect the boys and girls in your community from the disease. It is a good plan never to go into a home where there is an illness even when there is no sign on the door. Sick people need quiet in order to get well faster. Besides, you cannot be sure that the illness is not catching. If you are the one

Roberts

Supper's almost ready—time to wash!
These girls are as careful about their drinking water
on a camping trip as they are about washing
with soap and water before eating

"

who is ill, you will have the satisfaction of knowing that you are being a good soldier in the war against disease when you try to be cheerful about staying by yourself until you cannot give your illness to others.

Although a sign is placed on a home when someone inside has an illness that is catching, no signs are placed on people who are coming down with measles or scarlet fever or

How is the board of health in this town helping to protect its citizens?

whooping cough or some other communicable disease. Many diseases of this kind start as a cold starts.

For this reason a good rule to follow is to stay as far away as possible from the people who have colds. Make it a rule not to kiss anyone or to shake hands with anybody when you have a cold, and never allow yourself to be kissed or to have your hand shaken by a person who has one.

Another good rule is to stay out of crowds when many people in your community have a communicable disease. The board of health usually asks people not to go to the motion pictures or to parties or to travel about in crowded streetcars and busses during an epidemic. You may help the board of health to protect your own health and the health of other people by finding ways of having fun in your own home and yard.

MAKING THE BODY AN UNHEALTHY PLACE FOR GERMS

On a winter day about sixty-five years ago a young doctor stood on the porch of an older doctor's office in the city of New York. He stood in the sunlight, but the whole world looked dark. The doctor had said to him, "You have tuberculosis."

In those days very few people got well when they had tuberculosis. No one knew what causes it. No one knew what to do for it. But this young doctor, whose name was Edward Livingston Trudeau, loved the woods and the mountains. He said to himself, "I will go to the place I love the best to spend the little time I have left to live."

Trudeau went to the Adirondack Mountains. All summer long he spent most of each day lying in a boat fishing and watching the shores of the lake for the deer and other wild creatures that came to drink. His appetite soon came back and he ate heartily. He began to sleep well at night. He lost his fever. At the end of the summer he had gained fifteen pounds.

Trudeau decided to make his home in the mountains. After he had lived there for ten years, he had a dream. On a hillside sheltered from the wind where he loved to lie in the sun he dreamed that the forest melted away. In its place stood little houses. The houses were open on all sides to the air and sunlight. Trudeau dreamed of them as houses "built inside out." There were people in the little houses. The people had tuberculosis. But they were getting well, just as Trudeau was getting better and stronger, by eating plenty of good food and resting long hours in the fresh air.

Trudeau made his dream come true. On that hillside now stand little houses "built inside out." Most of

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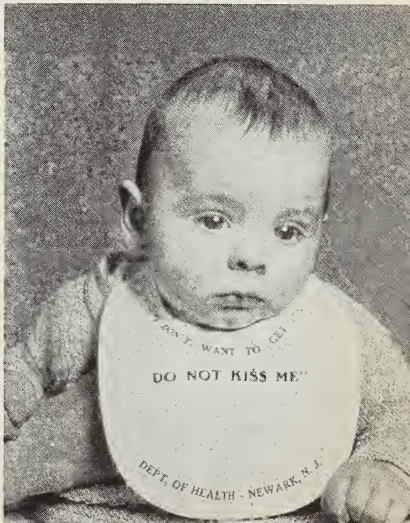
Lewis W. Hine and Cleanliness Institute



Babies especially need to be protected from harmful germs

the sick people in the houses are getting well. The young man who had stood in the darkness although the sun was shining had turned defeat into victory. His name and his spirit will always live, for they belong to the man who proved that the body can defend itself against the germ of tuberculosis if it is given a chance.

Today boys and girls are learning what Trudeau learned long ago. By plenty of sleep and rest, fresh air, good food, and sunlight it is possible to build the kind of body in which the germs of tuberculosis cannot live and multiply. This is true not only of the germ of tuberculosis but also of the germs of some other communicable diseases, such as colds and pneumonia. The lesson which Trudeau taught tells us that a healthy body is an unhealthy place for many kinds of germs.

In reading about vitamins you learned that another name for these food substances is "protective" foods. Not only do they help you to grow strong bones and teeth and firm muscles, but they also help to protect you against certain diseases. Vitamin A helps to protect people against colds. Foods which are rich in vitamin A are whole milk, butter, fruits, green and yellow vegetables, eggs, and cod-liver oil.

A rested body is better able to defend itself against harmful germs than is a tired body. Are you getting at least ten hours of sleep each night? Do you stop playing or working and rest awhile when you feel tired?

Outdoor play and work in the fresh air and sunlight help to make your body an unhealthy place for germs. Out of doors the air is nearly always in motion. Usually it contains the right amount of moisture. When you play or work outdoors and when you let fresh air into your home, you feel more alive. Fresh air and sunlight on the

An airplane view of Trudeau Sanatorium as it is today

©W. F. Kollecker

skin act as a tonic. Your skin feels soft and looks rosy. Your brain can work better than it can in a stuffy room.

Supplying a room with fresh moving air is called ventilation. This word comes from a Latin word meaning "a little wind." Since air moves when it is let into a room, the act of letting it in came to be called by the name which the Romans, who spoke the Latin language, used in speaking of a breeze.

Many experiments have been made to find out the best room temperature for health, comfort, and the ability to do good work. These experiments prove that when the temperature of a schoolroom rises above 68 degrees Fahrenheit the pupils begin to feel sleepy and tired and to lose

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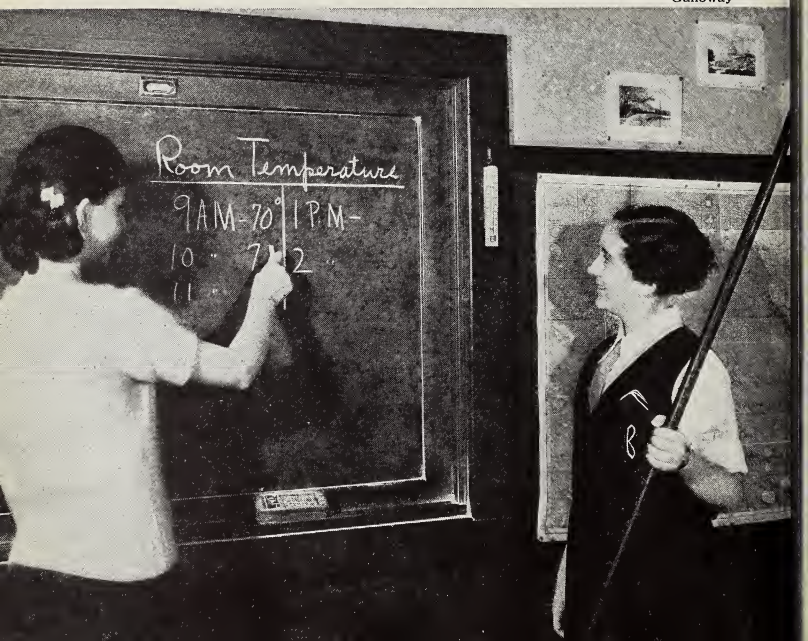
In this classroom a different student each day
is asked to make a record of the temperature.
What is the teacher about to ask one of the boys to do?

Galloway



interest in their work. If it falls below 68 degrees, they begin to feel chilly. For this reason great care is now taken in many schools to see that the temperature is kept at about 68 degrees throughout the school day.

How is the temperature controlled in your school? Do you have a thermometer in your classroom? If so, does it hang in a place where you can read it easily? Is a committee of pupils made responsible for reading the thermometer at certain times during the day? What is done in your room when the thermometer shows that the air is too warm or too cold?

How the Body Defends Itself against Harmful Germs

The tears with which your eyes are always bathed, the fluid which keeps the inside of your nose moist, the saliva in your mouth, the gastric juice in your stomach, and the white corpuscles in the blood all have the power to kill or make harmless some germs. But when germs enter the eyes or nose or mouth in large numbers, these germ-destroyers usually are not able to work fast enough to kill them all. However, the body has another way of defending itself when certain harmful germs have entered it in large enough numbers to cause illness.

Do you know what an antidote is? Perhaps you have seen on a bottle containing poison a list of things to do before the doctor arrives if someone takes the poison by mistake. For example, if a little child should drink iodine from a bottle left carelessly within his reach, the thing to do is to give him starch mixed with water while waiting for the doctor to come. Starch is an antidote for iodine. That is, it helps to work against the poison in the iodine.

How the Body Makes Antidotes

You have learned that disease germs make poisons. The body makes antidotes that work against the germs or their poisons. Another word for poison is *toxin.* The antidotes which the body manufactures to fight disease germs or their toxins are called antibodies. Each kind of disease germ is different from every other kind of disease germ. The body makes a special kind of antibody to fight each kind of germ. For example, it makes one kind of antibody substance to work against the germs of measles and another kind to work against the toxin of diphtheria and still another kind to work against the toxin of scarlet fever.

After the body has fought and won the battle against the germs of a certain communicable disease—measles, for example—usually a great many extra antibodies are left in the blood. These antibodies stay in the blood. If measles germs again find their way into the body, the antibodies keep them from causing measles. This is why a person usually does not catch measles, or scarlet fever, or diphtheria, or whooping cough after he has already had the disease once.

Why Vaccination Works

The wonderful power of the body to make antibodies led to one of the greatest of all discoveries. To understand this discovery we must go back to the last years of the eighteenth century. Then almost everybody had at some time or other the terrible disease smallpox. The ones who did not die of it were left with scars. These scars were like your vaccination scar. But instead of having just one scar, the whole body was covered with them after an attack of smallpox.

A country doctor named Edward Jenner proved in the year 1796 that he could protect people from smallpox by putting into their skins a tiny bit of clear fluid from a sore caused by cowpox. Cowpox is a mild disease of cows. As the Latin word for cow is *vacca,* this way of protecting people from smallpox was given the name "vaccination." No one knew why vaccination works. Even Jenner did not know.

Now we must skip ahead eighty-three years. In the year 1879, Louis Pasteur was studying a disease of chickens called chicken cholera. All the chickens that got the disease died. Pasteur grew the germs of this disease in chicken-gristle soup. Then he put some of this germ soup into chickens in order to study the disease caused by the germs.

Pasteur's study of chicken cholera was interrupted by the vacations of his helpers. When the helpers returned and work was started again, Pasteur found that his soup of chicken-cholera germs had become stale and weak. But he decided to use it anyway. He put some of it into the bodies of chickens. These hens showed all the signs of chicken cholera, but they *did not die.* Much to Pasteur's surprise, they got well. Then Pasteur put some fresh strong germs into the same chickens. They did not get chicken cholera. They remained perfectly well, although other chickens given fresh strong germs died.

Pasteur had found out why vaccination works. What he had discovered was this: In fighting the weak germs of a certain disease, the body manufactures antibodies that protect it against the strong germs of the same disease.

Smallpox germs are made weak by living in a cow. Weak smallpox germs are put into a person's body when the person is vaccinated. These weak germs cannot give the person smallpox. But they do cause the body to make antibodies to fight the germs of smallpox. These anti-

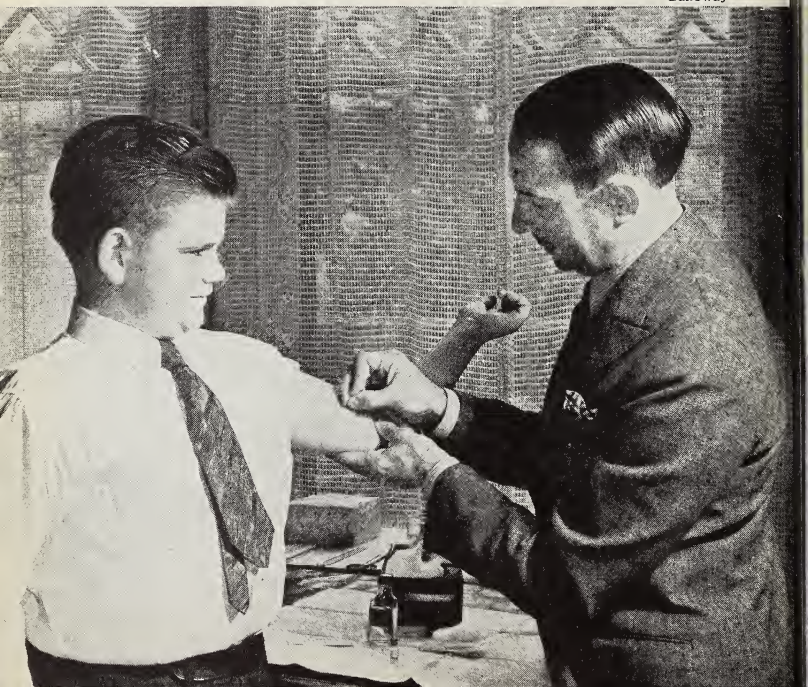
bodies stay in the blood and protect the person from smallpox germs which later may get into the person's body.

Ways have been found to make the germs of other diseases or their toxins so weak that they cannot harm the body. These weak germs or weak toxins make it possible for the body to manufacture antibodies. Then the strong germs cannot cause the disease if they get into the body.

Babies can be protected from diphtheria by a simple harmless liquid called toxoid or toxin-antitoxin. Are you protected from diphtheria? Doctors can protect children from whooping cough and scarlet fever if they think it is necessary. People can be vaccinated against typhoid fever. Perhaps other diseases will be conquered some day.

"It doesn't hurt!" Have *you* been vaccinated against smallpox?

Galloway



ARE YOU DOING YOUR BEST TO GUARD YOUR BODY AGAINST INFECTIONS?

Do you put an antiseptic on every break in the skin?

Do you cover wounds deeper than a scratch with a bandage of sterile cloth?

Do you drink only pasteurized milk?

Do you boil all drinking water when you are not sure that it is pure?

Do you wash your hands with soap and water before handling food and before eating it?

Are you careful never to cough or sneeze on food?

Do you help your mother to keep the food in your home protected from dirt, dust, rats, mice, and flies?

Do you throw away all food that has fallen on the floor?

Are you careful never to eat anything that has been partly eaten by someone else?

Do you stay away from homes in which there is sickness or that have a quarantine sign on the door?

Do you stay away from crowded places, such as motion-picture theaters, when there is an epidemic of communicable disease in your community?

Have you been protected from smallpox and diphtheria?

Do you think of your doctor as a friend who helps you to benefit by all the wonderful discoveries that have been made to protect the body against communicable disease?

TRY THESE TESTS

1. Tell what you think of in connection with each one of the following words or names. (*Do not write in the book.*)

ferment	Joseph Lister
fermentation	ventilation
bacteria	microscope
germs	antiseptic
alcoholic fermentation	toxin
pasteurization	antitoxin
infection	vaccination
Louis Pasteur	Anton van Leeuwenhoek
Edward Jenner	Edward Livingston Trudeau

2. Supply the missing word or words in each of the following sentences. (*Do not write in the book.*)

a. Harmless __?__ change apple juice to vinegar.

b. When yeast eats the sugar in grape juice __?__ and __?__ __?__ are thrown off.

c. Each kind of communicable disease is caused by a special kind of living __?__ which enters the body from the __?__.

d. Most germs need __?__ and __?__ and __?__ in order to grow and multiply.

e. Cloth which is free of germs is called __?__ cloth.

f. The bacteria of typhoid fever leave the body of a person sick with it in wastes from the __?__ __?__.

g. A good health rule is to stay out of crowds during an __?__.

h. Starch is an __?__ for iodine.

i. A person who has had measles usually cannot get it again because the __?__ manufactured by his body to fight the measles germs remain in his blood.

THINK ABOUT THESE QUESTIONS

1. What are the names of some useful and some harmful plants and animals that you can see with the eyes alone? What are the names of some useful and some harmful

dwellers in the world of living things that you can see only with the help of a microscope? Why is the fight against harmful germs so difficult? What are some of the things we have learned about harmful germs which tell us how we may fight them?

2. We may make a plant healthy by growing it in soil containing food that it likes and by giving it plenty of water and sunlight. We say that conditions are favorable for growth when a plant has the things it needs for growth. We may make a plant weak and sickly by not giving it conditions that are favorable for growth. Germs also may be made strong by growing them under conditions that are favorable, and weak by growing them under conditions that are not favorable. Why did this knowledge about germs help Pasteur to explain why vaccination works? How may you make conditions inside your body not favorable for the germs of smallpox? of diphtheria? of colds?

DO THESE THINGS

1. Wash a white potato thoroughly. Peel it and wash it again. Cut two slices from the potato, each one about a quarter of an inch thick. Put one piece of potato on a clean saucer and cover it with a clean glass. Put the other piece into a warm oven for about 45 minutes. The oven must be warm enough to dry out the potato, but not to burn it. Put this potato also on a clean saucer and cover it with a clean glass. Put both saucers away in a warm dark place. Examine the slices of potato every day to find out which one shows little spots. The spots are groups of bacteria. It takes many thousands of bacteria to make spots that you can see. At the end of a week see if you can answer these questions: Do bacteria need moisture for growth? What necessary condition for growth do bacteria find in the mouth, the nose, the throat, and the large and small intes-

tines? What is one of the reasons why most disease germs die when they are outside of a living body? Why may disease germs stay alive for some time outside of a living body when they are in milk or water?

2. Fill two small glasses half full of fresh sweet milk. Raw unpasteurized milk is best to use, if you can get it. If not, use pasteurized milk. Put one glass of milk in a warm dark place. Put the other in an icebox or some other cold dark place. Look at and smell the milk in the two glasses each day for four days. At the end of four days see if you can answer these questions: Do bacteria need warmth for growth? What necessary condition for growth do bacteria find in the body?

3. Get two perfect ripe apples. Wash both apples thoroughly. With a blunt dirty knife make a cut through the skin of one apple. Rub some dirt over the cut. Rub some dirt on the other apple. Put each apple on a clean saucer and cover it with a clean glass dish. Put both in a warm dark place. Look at the apples each day. At the end of a week see if you can answer these questions: In which of the two apples is decay taking place? Does the skin of an apple help to protect it from decay? Compare the protection against bacteria that the apple skin gives the apple with the protection against bacteria that your skin gives you. When you cut through your skin, what may you do to keep bacteria from growing in the cut?

4. Ask a committee of the class to find out which members have had other communicable diseases besides colds. The parents may be asked to help. Which members of the class have been vaccinated against diphtheria and smallpox? Have any been protected from other communicable diseases? Make a chart to show what the committee finds out.

Have any of the boys and girls had any communicable diseases, besides colds, more than once? Explain why one attack of a communicable disease, such as measles, chicken pox, and scarlet fever, usually protects a person against a second attack. Explain why vaccination keeps people from getting the disease against which they were vaccinated. Why is it that vaccination against smallpox does not protect a person from diphtheria?

5. Ask another committee of the class to find out how doctors today may discover whether or not the germs of tuberculosis have entered a person's body. The committee may ask the school doctor, or some other doctor, for this information.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

communicable disease
fermentation
ferment (noun)
alcoholic fermentation
pasteurization
carbolic acid
antiseptic
solution
surgery
sterile
typhoid fever
ventilation
antidote
toxin
antibody
cowpox
toxoid
toxin-antitoxin
bacteria
disinfect

2. Tell the difference between the following words or terms:

fermentation and pasteurization
antiseptic and sterile
toxin and antibody
ventilation and vaccination

UNIT X

The Secret of Safety

Have you read the story of the famous hero Achilles? When he was a tiny baby, according to the story, his mother dipped him in the river Styx. The water of this river was supposed to protect people from outside injury. Achilles' mother held her baby by the heel when she dipped him in the river. Therefore the water could not reach his heel. As the story goes, this was the one spot on the hero's body that could be hurt. Later a poisoned arrow shot into his heel caused his death when he was fighting before the walls of Troy. Probably you can think of other myths and fairy tales in which the hero had a magic sword, a cloak of darkness, a cap of invisibility, or some other means of protecting himself from harm.

To this very day you will find people who believe that charms will protect them from accidents. Do you know anyone who carries a rabbit's foot or wears a lucky ring? Have you ever seen a bicycle or a motorcycle with a raccoon's tail hanging from the handlebars?

The people who depend on luck or any kind of magic to protect them from harm are people who wish to get something for nothing. Instead of expecting good luck or magic of any kind to protect them from harm, boys and girls today are learning that the best "charm" against accidents is their own skill.

DO YOU KNOW

What rule of safety Lindbergh practices before his airplane even leaves the ground?

What hand signals to make while riding a bicycle to show other people what you are going to do?

How to choose a safe place for coasting downhill?

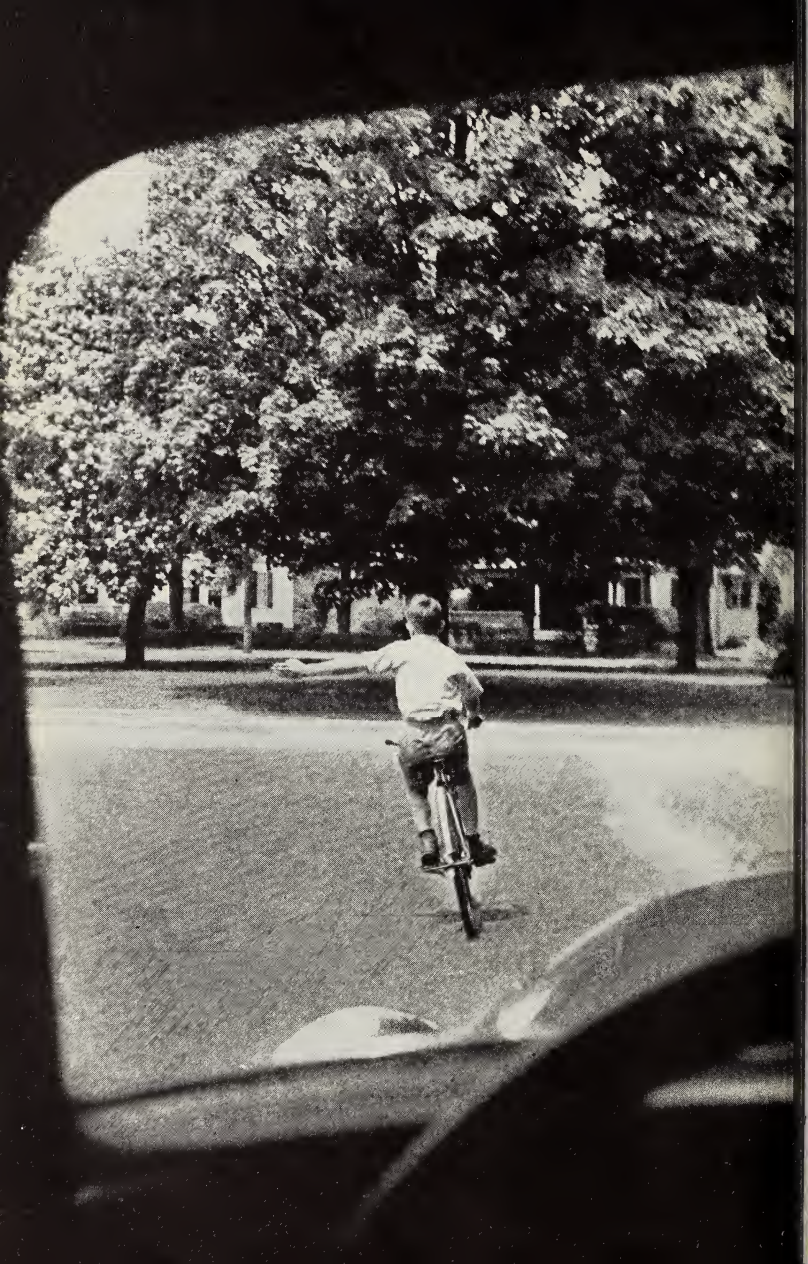
How to be a "safe walker"?

A good safety rule to practice while roller-skating?

How to make school days safe days?

How you may help to make your home safe?

What chances you take when you ask a stranger for a ride?



Perhaps you have heard it said that a skillful workman is known by his tools. Boys and girls who own bicycles, sleds, express wagons, ice skates, roller skates, or skis can show their skill by making sure that their possessions are always in good condition. Loose steering gear in a bicycle, sled, or wagon, a weak sled runner, a soft bicycle tire, a broken strap, a loose wheel on a roller skate or wagon may cause a serious accident. The owner of a bicycle should make sure that the handlebars are high enough to allow him to sit erect. When the bicycle or sled or wagon is not in use, it should be kept in a safe place where people will not stumble over it.

Learning how to take proper care of the vehicles you own is also very good practice for the time when you may have an automobile or an airplane, instead of a bicycle or wagon, to check for safety. One of the secrets of Lindbergh's success as an aviator is the extreme care he takes to make sure that his airplane is in perfect condition before he leaves the ground.

Riding a Bicycle

Skill means good judgment in choosing the place and the time to do things as well as the ability to do them properly. We do not call a boy a skillful bicycle-rider if he rushes out of a driveway on his bicycle into a busy street. Most automobile-drivers watch out for boys and girls on bicycles, but good bicycle-riders also form the habit of looking out for automobiles. In riding a bicycle in traffic, the rider shows that he knows the rules of traffic by keeping to the right and near the curb or side of the road. When

"What is this boy telling the motorist behind him that he is going to do?

Steven A. Coons

boys and girls are riding bicycles in groups of two or more, they should go in single file when meeting or overtaking another vehicle. Riding abreast or steering in and out of traffic is dangerous, and it is unfair to motorists, because automobiles travel much faster than bicycles do and cannot dodge so easily.

At street crossings where there are signal lights, the skillful bicycle-rider stops for the red light and goes only on the green. He watches out for pedestrians, that is, people on foot. If he makes a turn, he gives the proper hand signal. In most communities the left arm held out straight means "a left turn"; the left arm raised means "a right turn"; and the left arm lowered means "stop" or "slow." It is a good thing to learn these signals and practice them while riding a bicycle, because you will use the same signals later if you learn to drive a car. At night the bicycle-rider should place a white light on the front of his bicycle and a red taillight or reflector at the rear. A skillful bicyclist does not take a little brother or sister or any other child for a ride on the handlebars of his bicycle. It is hard to keep the proper balance and to steer straight if two people try to ride a bicycle built for one.

Holding or hooking onto the back of an automobile, a truck, or a streetcar, while on a bicycle, a wagon, a sled, or roller skates is taking a chance of meeting with a serious injury. The driver may increase his speed suddenly, or come to a quick stop, or perhaps turn so quickly that the boy or girl will be run over. There is also great danger of being crushed by another car.

Perhaps you have seen boys stealing a ride on the back of a truck or a trolley car. It is not fair to the driver of a vehicle to do this. Besides, in jumping on or off the back of the vehicle, a boy may be run over by an approaching automobile.

The lost is found.

What good safety lesson did Don teach Lucy?
(See page 247)

KODACHROME BY STEVEN A. COONS

Skill in Coasting

Coasting downhill on a wagon or sled is fun and good exercise. But for this sport the skillful coaster chooses a place where he will not bump into pedestrians or into an automobile or a streetcar or a railroad train at the foot of the hill.

In many cities some streets on side hills are closed to other vehicles after a snowfall so that boys and girls may have a safe place in which to coast. Hills in city parks also make safe coasting places. Country boys and girls usually can find hills away from the highways where they may coast without having to keep on the lookout for passing automobiles.

Unless a policeman is standing at a place where a street or road cuts across the track of a coasting hill, the coasters should take turns acting as safety patrols to warn the others when a car is approaching. It is a good idea to put sand or ashes at the foot of a coasting track if it runs into a street where there is traffic or into a stone wall, fence, railroad track, pond, or any other danger spot. If you ever find that you cannot turn or stop your sled quickly enough to keep from hitting something, remember that you can always roll off. In doing this, protect your face with your arms and roll quickly to the side away from sleds coming down the hill.

Skillful coasters follow the rules of traffic just as skillful bicycle-riders do. In coasting down the hill, keep always to the right. To steer a sled toward a group of children walking uphill, just to give them a scare, is to act like a bully instead of a good sport.

Have some sort of order in taking off from the top of the hill. This is always done on famous coasting runs so as to prevent accidents. The sleds should not follow each

other too closely, and children who have small sleds should permit bobsleds to go first. As you approach the foot of the hill, shout to let those who have reached the bottom know that you are coming. In walking back up the hill, keep out of the way of coasters.

Riding in Other Vehicles

When you ride in an automobile or bus or trolley car or railroad train, keep your head and arms inside the windows. It is safer to be on the inside looking out or on the outside looking in than it is to be halfway in and halfway out. In getting out of an automobile, step from the side of the car which is next to the curb or edge of the road. If you leave on the side toward the street, you may step directly into the path of a moving car.

When you are leaving a streetcar, face ahead in getting off. Make sure, before you step into the street, that no automobile is trying to pass the streetcar. It is against the law in most places for an automobile to pass a standing trolley car, but some drivers are careless. Do not start to cross the street in front of or behind a streetcar or bus when you get off, because another vehicle may be passing on the opposite side.

SKILL IN WALKING

You cannot go more than a block in any direction in a city without having to cross a street. If you live in the country, you may walk along or cross a busy county or state highway on the way to school. Years ago, in the days of horses and wagons, crossing a street did not require much skill. When your fathers and mothers were going to school,

they could run across a street or road without looking. Now city streets and country highways are crowded with fast-moving automobiles. In order to cross a street without breaking your bones while doing so, it is necessary to know when and where and how to cross.

Crossing the Street

The right place to cross a street is where two or more streets meet. This place is called an intersection. People who are driving automobiles do not expect to meet pedestrians, that is, people on foot, crossing a street between intersections. Pedestrians who do this are called "jaywalkers." If a jaywalker gets in the way of an approaching automobile, the driver may not see him in time to stop.

At busy intersections traffic lights or traffic policemen or both direct traffic. If a policeman is standing at an intersection where there is also a traffic light, his orders are to be obeyed rather than the light signals. Automobile-drivers must obey traffic lights. If they do not, they are arrested. If pedestrians try to cross a street when the light signal is against them, they slow up traffic. This is unfair to the people who are driving automobiles. Besides slowing up traffic, such people may cause a serious accident.

At a street intersection where there is no traffic light or policeman, and on busy country highways, keep a sharp lookout for automobiles when you cross the street or road. Look in both directions and wait until the street is clear before starting to cross. Then walk in a straight line to the other side.

In some schools members of the Schoolboy Patrol help to protect children in crossing streets near the school. A member of the Schoolboy Patrol does not direct traffic. He simply stands on the sidewalk near the curb and keeps

the children from crossing the street until it is safe for them to do so. Have you a Schoolboy Patrol in your school?

Walking along the Road

When you walk along a road, it is safest to walk on the left so that you face cars coming toward you. You can then see an approaching car and step completely off the road to get out of its way. If you walk on the right, you cannot see cars which come up behind you, and you may step too far into the road at the moment a car is starting to pass you.

Have you ever seen anyone standing beside a road begging a ride from passing motorists? A person who does this is called a "hitchhiker." Many people travel about the country by hitchhiking. Sometimes boys and girls who have a long distance to walk to school, or who have missed the school bus, or who do not wish to wait for the bus will beg a ride of strangers. It is well for boys and girls to know the chances they take when they ask strangers for a ride. They may find themselves riding with a reckless or drunken driver, or perhaps with a criminal. Never ask a motorist for a ride unless you know him well and are certain that he is a safe driver.

MAKING SCHOOL DAYS SAFE DAYS

The town of Springdale had a new school. On the day classes were first held in the new building Mr. Thomas, the president of the school board, made a speech.

"This school is now your school," he said. "The people who planned it and the people who built it have done everything possible to make the building and the

"Why is the side of the road to the walker's left the right side to walk on?"

Steven A. Coons

Roberts

These boys are taking off their skates
before crossing a street where the traffic is heavy

playground pleasant, safe places in which to work and play. Now it is your turn. I hope you will all try very hard to make school days safe days in our town."

When Mr. Thomas had gone, the principal of the school suggested that the boys and girls form a school safety council. This seemed a good suggestion. Committees were formed from the fifth and sixth grades to make up safety guides for different parts of the building and grounds. At the next assembly these committees made their reports. On the following pages are the safety guides which the committees made up and which all the boys and girls of the school were asked to follow.

Safety Guides for the Corridors and Stairways

Have traffic officers to keep order at the entrances and in the corridors at the times when a great many boys and girls are entering or leaving the building or passing from place to place in the building.

In walking through the corridors and up and down stairs, keep to the right just as automobiles do in the street. Keep going; gathering in crowds to talk things over holds up traffic. Walk; do not run or slide. Look where you are going.

Walk up and down the stairs one step at a time. Make sure that your shoelaces are tied so that you will not trip over them. A good thing for girls to remember is that high heels may cause a tumble in going up and down stairs.

Be careful not to spill water on the floor when using a drinking fountain and when washing your hands in the washroom. If you should accidentally spill water, wipe it up.

Learn the location of all the doors leading out of the building, especially those nearest your classroom.

Corridors and stairs are not safe places in which to do stunts or to play tricks. Remember that the playground is the place for play.

"

WPA Federal Art Project

In some schools boys of the Safety Patrol control traffic inside the school building

Safety Guides for the Classroom

Have a safety committee for each classroom. The members of this committee should be changed from week to week so that all the boys and girls in the class will have a chance to serve on it. Here are some of the ways in which the class may help the committee to make the classroom a safe place:

Keep the aisles, the doorways, and the fire-escape exit in each classroom free of things over which someone may stumble. When any article, such as a book, pencil, or blackboard eraser falls on the floor, pick it up at once. Keep your feet under your desk and not sprawled out into the aisles.

Always keep your coats, hats, sweaters, overshoes, and umbrellas in your cloakroom or locker.

Store tools and materials used in handwork in their proper places when you are not working with them.

Hold sharp-pointed objects, such as scissors, pencils, and pens with their points down. Look where you are going, and do not run when you are carrying any kind of sharp-pointed article.

Try to remember to keep things out of your mouth that do not belong there. This means that you should not lick or chew pencil points or hold pins, beads, pen points, coins, or any other object in your mouth.

Do not open a door in a hurry or slam it shut, as you may hit someone on the other side. In opening swing doors, push on the "push" plate. Never push or lean against a door or a window.

As cloths soaked with oil or turpentine and stacks of newspapers catch fire easily, these articles should not be left in the classroom.

Keep desk drawers closed. Do not keep so many things in your desk that you cannot close the drawers tightly.

Have safety officers on the playground as well as in the school building; but everyone, even the youngest children, should feel responsible for keeping the playground in a safe condition.

Anyone who sees anything on the ground which may cause an accident should pick it up. Objects such as glass, nails, sharp-pointed sticks or stones, and fruit peelings, and all other rubbish should be picked up and placed in the rubbish containers on the playground. Good citizens will also remove such things as papers or eggshells that give the playground an untidy appearance even if they are not really dangerous.

Committees of older boys and girls should daily test the swings, teeterboards, slides, and giant strides used by the younger children and report promptly any piece of apparatus that needs repair. The children should not be allowed to use broken apparatus until it has been mended.

Older boys and girls should always test playground apparatus before using it themselves.

Vigorous running games, such as baseball or football, should be played at a safe distance from groups of small children. Boys and girls watching the game should keep out of the way of the players.

Snowball fights, the throwing of sand, stones or sticks, and the use of peashooters, slingshots, bows and arrows, air rifles and other toy weapons should all be forbidden on a crowded playground. A part of the playground far away from the school building may be set aside for snowballing after a snowfall.

Climbing is lots of fun for those who have learned to do it skillfully, but it is not fair to climb things on school property which were not meant to be climbed. You may

damage something or hurt yourself and cause other people a lot of trouble for something which was not their fault. For this reason you should stay off walls, roofs, fences, fire escapes, and the framework of swings and slides.

After the reports had been read, the whole school voted to follow all the safety guides made up by the different committees. All the boys and girls in this school now realize that school can be a safe and happy place only if they try to be orderly on the stairs and in the corridors and classrooms. They are finding out that they can add to the fun they have on the playground by making rules for their games which protect the safety of the players. Are you finding out these things in your school?

IS YOUR HOME SAFE?

Probably you have often heard the expression "safe at home." And yet about one third of all the accidental deaths and injuries which take place in one year happen in the home. You may have read stories about people who have had all sorts of exciting adventures in the far places of the earth, or who have come home from war without a scratch, only to slip in the bathtub and break a rib or fall downstairs and break a leg. The accidents that happen at home are usually falls, burns or scalds, taking poisons by mistake, or breathing poisonous gas from a stove or furnace. Sharp-pointed instruments, such as knives and scissors, also cause many home accidents.

Make the home as safe as possible. A good occupation for a rainy day is to make a picture map of all the rooms in your home. On this map locate everything which might possibly cause an accident. If you see people doing unsafe things, put them in the picture, too.

A Safety Meeting

Tom and Lucy are in the sixth grade. They have twin brothers, five years old, named Donald and Ronald. One day last winter after studying in school about the causes of home accidents, Tom and Lucy made picture maps of the rooms in their home to show the danger spots. After making the maps Tom and Lucy had a talk with their father and mother to see what could be done to make their home safer. Tom made a list of the things that he and his father would be responsible for doing, and Lucy made a list of the things she and her mother would do. From the list can you tell what Tom and Lucy found which might have caused an accident in their home?

Tom and Father

Fix the stepladder. NOTE. Mother promises never again to stand on a rocking chair to straighten a picture.

Make a fire screen for the fireplace. Be on the lookout for anything else that might cause a fire.

Build a shelf high up on the kitchen wall for mother's cleaning supplies.

Nail the matchbox in the kitchen high up where Don and Ron cannot reach it.

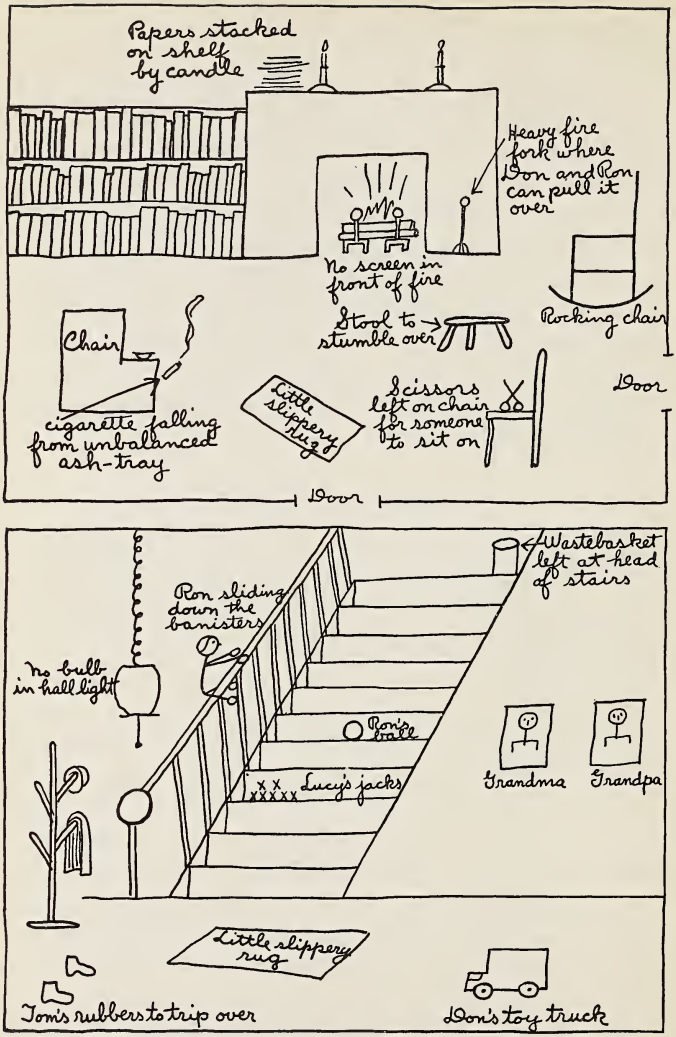
Make a wall cabinet in the bathroom for medicines.

Lucy and Mother

Make labels for all the medicine bottles. Stick pins, points down, in the corks of bottles containing poison, such as the iodine bottle and the bottle of rubbing alcohol. This will remind people that the bottles contain poison.

Put pads under all the small rugs in the house to keep them from slipping.

Keep a light burning in the electric lamp in the hall.



Here are Tom and Lucy's picture maps of the living room, hall, and stairway in their home

Remember to keep the handles of pots on the stove turned toward the wall.

See that no piece of furniture is placed where people may stumble over it.

Make sure that the electric iron and the electric toaster are turned off immediately after use.

See that no toys or other articles are left lying on the floor or stairs.

Stick the points of the scissors in a large cork and put them in the sewing basket after using them.

The five-year-old twins, Don and Ron, nodded very solemnly when Tom and Lucy asked them if they could remember to pick up their playthings and put them away after using them. A few days after the household had started the safety campaign, Lucy came home from school and laid her roller skates on the stairs while she ran up to the bathroom to wash her hands. When she came down, she could not find the roller skates anywhere. She hunted and hunted. The next afternoon she was helping Don to pick up his toy blocks and put them in his play box. In the box Lucy found her roller skates. Don had put them away because Lucy had told him that nothing must ever be left lying around on the floor or stairs. Don had taught Lucy a good safety lesson.

ARE YOU DOING YOUR BEST TO PRACTICE THE BEST AND SAFEST WAYS OF DOING THINGS?

Do you make the rule of safety a part of the rules of every game you play?

Do you take proper care of your belongings?

Do you use good judgment in choosing the place to ride a bicycle, to coast, and to roller-skate?

Do you obey the traffic rules of your community when riding a bicycle, coasting, roller-skating, and walking?

Are you helping to make school a safe place by following the safety guides outlined by your principal or by the school safety council?

Do you help to protect the safety of younger children in the school building, on the playground, in the streets, and at home?

Are you helping your parents to make home a safe place by removing unsafe conditions and by overcoming any unsafe habits you may have?

1. Choose the best ending for each of the following sentences. (*Do not write in the book.*)

a. When riding a bicycle in traffic

(1) keep to the right side of the road.
(2) steer in and out among the cars.
(3) ride with your hands off the handlebars.

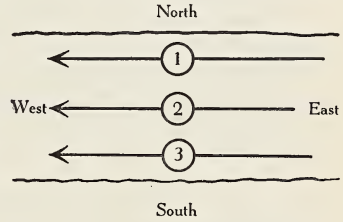
b. The way to have fun roller-skating is to

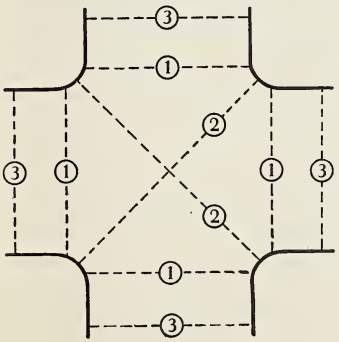
(1) skate back and forth across a busy street.
(2) hook on backs of trucks.
(3) skate in places where there is little or no traffic.

c. If you have to cross a street or road after getting off a bus,

(1) run in front of the bus before it starts.
(2) wait till the bus has gone ahead so that you can see whether the street is clear.
(3) cross the street behind the bus.

d. In walking west along a country highway it is safest to walk at (1), (2), or (3), in the diagram at the right.





e. The safest place to cross a street is at (1), (2), or (3) in the diagram at the left.

2. Look up the meaning of the word *sportsmanship.* Which of the following practices are good sportsmanship? Which are poor sportsmanship? Give the reasons for your choices. (*Do not write in the book.*)

a. Riding bicycles three abreast on a country highway.
b. Stopping for the red light while riding a bicycle.
c. Hooking a sled on the back of a truck going uphill.
d. Coasting down a city street not set aside for coasting.
e. Throwing snowballs at passers-by.
f. Crossing streets only at intersections.
g. Crossing a street against the light.
h. Walking to the left on a road that has no sidewalk.
i. Hitchhiking.
j. Removing roller skates before crossing a busy street.
k. Running or shoving in the corridors at school.
l. Going up or down stairs two steps at a time.
m. Picking up things from the floor of the classroom.
n. Picking up nails or bits of glass from the school playground.
o. Teasing younger children on the playground.
p. Climbing fences or walls on school property.
q. Keeping one's belongings in their proper places at home.

THINK ABOUT THESE QUESTIONS

1. What is the difference between risking your life for fun or to save a few minutes or for a foolish dare and risking your life in the line of duty or to save someone else's life? What are some of the ways in which you can show your bravery without going out of your way to hunt for dangerous things to do? Do you think it is silly or cowardly to take every possible precaution to protect yourself from unnecessary risks? What are the reasons for your answer?

2. What are some of the ways in which courtesy makes for safety in the corridors and classrooms of a school building, on the playground, and in the streets?

3. What are the responsibilities of the pedestrian, the bicycle-rider, the coaster, and the roller-skater in preventing street accidents?

4. What are some of the ways in which the children in a family may help to make home safe?

DO THESE THINGS

1. Select a committee of the class to study and report to the class the traffic rules and regulations of your community. Information may be obtained from the police department. Find out the rules pedestrians must obey as well as the rules that must be obeyed by the drivers of vehicles. Are there any rules which state that a pedestrian cannot collect damages when he is hit by a vehicle if he is to blame for the accident?

2. As a class activity keep a record of all the minor and major accidents that happen in school and in the homes of the students. Discuss in class each accident as soon as possible after it has happened, and decide how it might have been prevented.

3. As a class activity make lists of safety guides to be used in selecting safe places for coasting and roller-skating. Then have groups of students make a study of the neighborhood to find out whether there are any places where these activities may safely be carried on. If not, discuss in class what the students may do to secure safe play places of this kind.

4. Have members of the class watch activities on the school playground during play periods. Have each watcher make a list of the safe and unsafe practices noted. Discuss these notes in class and make a list of rules for fair play on the playground.

5. Have members of the class bring in newspaper stories of rescues made because the rescuer knew what to do and had the skill to do it. Compare these stories with other newspaper stories of people who lost their lives in trying to rescue someone because they did not keep their heads or did not have the necessary skill to make the rescue.

6. Make a picture map of the rooms in your home and on it locate all the danger spots. Talk over with your parents the danger spots found and ask them to help you make a plan for removing them.

WORD STUDY

1. Be sure that you know the meaning of and can pronounce correctly the following words or expressions:

invisibility	pedestrian	apparatus
charm	hitchhiker	sportsmanship
abreast	intersection	precaution
steering gear	jaywalker	
school safety council	corridor	

2. Complete each of the following sentences with a word or words from the list above. (*Do not write in the book.*)

a. A __?__ begged a ride of John's father.

b. A policeman called Helen a __?__ because she crossed a street between __?__s.

c. Some people think that a lucky ring is a good __?__ against accidents.

d. It is poor __?__ to throw snowballs at little children.

e. Slides and swings are good pieces of __?__ for a children's playground.

f. A __?__ who waits for the proper traffic light before crossing a street will not be hit by an automobile.

BOOKS TO READ

Andress, J. Mace, and Goldberger, I. H. *Broadcasting Health.* Ginn and Company, Boston, 1933.

The boys and girls in this story, with the help of their teacher, plan a new health activity. It centers around food. They all get together and make their lunchroom clean, healthful, and pleasant. They broadcast talks on health in their classrooms. They take trips to learn more about foods and health, and they publish a very unusual paper called *The Health News.*

Andress, J. Mace, and Goldberger, I. H. *The Health School on Wheels.* Ginn and Company, Boston, 1933.

The boys and girls of a make-believe city, called Brightville, are anxious to know how their city keeps healthy, and how they may live safe and healthy lives and help the community. They visit the city with their teacher in a big yellow bus. In this travel book you will learn much about building your own health.

Collins, A. F. *Experimental Chemistry.* D. Appleton-Century Company, New York, 1930.

The fourteenth chapter of this book has many useful suggestions for fixing up a home laboratory. There are several experiments that may be useful in the study of this book. Chapter I gives several experiments on oxygen and nitrogen.

Craig, Gerald S., and Johnson, Goldie M. *Our Earth and Its Story.* Ginn and Company, Boston, 1932.

This is an interesting book on general science. The last unit, "Men Make the World a More Healthful Place," takes up topics such as "Ideas about Diseases Have Changed," "How We Are Supplied with Pure Water," "How Waste Materials Are Removed," and "How Diseases Are Kept from Spreading."

Donnelly, Grant L. *Alcohol and the Habit-Forming Drugs.* Alfred Williams and Company, Raleigh, North Carolina.

This book, written by a physician for boys and girls, attacks the belief that alcohol and the habit-forming drugs help to build health. The author shows from his study of science that alcohol is a poor master and a false friend.

Hallock, Grace T., and Wood, Thomas D. *Grain through the Ages.* The Quaker Oats Company, Chicago, 1927.

Colored pictures and interesting stories about the first grains, farms, mills, and cooks of long ago make this a book you will enjoy reading.

Laird, Donald. *How to Sleep and Rest Better.* Funk & Wagnalls Company, New York, 1937.

This little book is the story of what scientists have found out about sleep. You will find the graphs and illustrations interesting. Read it with Unit VIII.

Rolt-Wheeler, Francis W. *The Boy with the United States Lifesavers.* Lothrop, Lee & Shepard Company, Boston, 1915.

Boys and girls who wish to know about the adventure of being a lifesaver employed by Uncle Sam will like this book.

Smillie, W. G. *The Common Cold.* Funk & Wagnalls Company, New York, 1937.

This little book tells in simple language the most important facts about the cause, treatment, and prevention of colds. Read it along with Unit IX.

The Book of Knowledge. The Grolier Society, New York.

In this set of reference books you will find the answers to many interesting questions. For example, under the general title of "Conquerors of Disease" there are questions like these: Do diseases ever disappear? Is the country more healthful than the city? Are we healthier than our ancestors?

Compton's Pictured Encyclopedia. F. E. Compton & Co., Chicago.

Contains much interesting and useful information. You will be curious about things just mentioned in your book. See what you can find about them in this encyclopedia.

Hygeia. The American Medical Association, Chicago.

This monthly magazine is found in most libraries. It is a good habit to look over the magazine every month for its interesting pictures, stories, puzzles, and poems. Almost every number contains something relating to the units in your book.

Rules of the Road. American Council on Education, Washington, D.C.

This little book tells about the first traffic rules made centuries ago, and how and why they have changed up to the present day. It contains interesting illustrations.

Safety Education: A Magazine of the Good Adventure, Chicago.

This magazine appears every month during the school year. It is inexpensive; if it is not in your library, ask the librarian whether it can be ordered. There are pictures, puzzles, letters, and compositions of children; also poems and news about safety, and notices of new books on safety. You will find something of interest in it every month.

The World Book Encyclopedia. W. F. Quarrie Corporation, Chicago.

This set of books contains nineteen volumes, with 14,000 illustrations. It is very useful for finding additional information on health problems.

FOOD TABLE

FOOD	100-CALORIE PORTIONS
Apple, baked	½ large apple and 2 tablespoons juice
Apple, fresh	1 large apple
Applesauce	⅜ cup
Apricots, stewed	¼ cup
Asparagus, fresh	20 stalks
Bacon, cooked	4 small slices
Banana	1 large banana
Bean soup	¾ cup
Beans, baked	⅓ cup
Beans, string	2 cups
Beef liver	2.1 ounces
Bread (white, whole-wheat, or graham)	slice ½ inch thick from medium-sized loaf
Butter	1 level tablespoon
Cake, chocolate layer	½ small slice
Carrots, fresh	4 or 5 young carrots
Celery	4 cups of ¼-inch pieces
Cheese, American	1⅛-inch cube
Cheese, cottage	5½ tablespoons
Cheese, cream	piece 2 inches by 1 inch by ⅜ inch
Cherries, fresh, stoned	20 cherries ⅞-inch in diameter
Chicken, roasted	1 slice 4 inches by 2½ inches by ¼ inch
Chocolate fudge	1-inch cube
Clams	6 to 12 clams, according to size
Cocoa	½ cup
Codfish, creamed	½ cup
Cod-liver oil	1 tablespoon
Cookies	1 cooky 3 inches in diameter
Corn bread	slice 2 inches by 2 inches by 1 inch
Cornflakes	½ cup with ¼ cup milk and 1 teaspoon sugar
Crackers, graham	2 crackers
Crackers, saltine	6 crackers
Cream, thin, 18 per cent fat	¼ cup
Cup custard	⅓ cup
Dates	4 dates
Doughnuts	½ medium-sized doughnut
Egg	1 large (average size contains 70 calories)
Farina, cooked	⅓ cup with ¼ cup milk and 1 teaspoon sugar
Figs	1½ figs
French dressing with salad oil	1½ tablespoons
Grapefruit	1 grapefruit
Ham	1 slice 4¾ inches by 4 inches by ⅛ inch

FOOD TABLE (*Continued*)

FOOD	100-CALORIE PORTIONS
Hamburg steak	cake 2½ inches in diameter, ⅞ inch thick
Honey	1 tablespoon
Ice cream	⅓ average soda-fountain portion
Jellies	1 tablespoon
Lamb chops, broiled	lean meat of 1 chop 2 inches by 1½ inches by ¾ inch
Lettuce	2 heads
Macaroni and cheese	½ cup
Maple sirup	1 tablespoon
Mayonnaise dressing	1 tablespoon
Milk	⅝ cup
Muffins	¾ muffin
Oatmeal, cooked	½ cup with ¼ cup milk and 1 teaspoon sugar
Olive oil	1 tablespoon
Onions, creamed	2 onions
Oranges	1 large
Peaches, canned	2 large halves and 3 tablespoons juice
Peaches, fresh	3 medium-sized
Peanut butter	1 level tablespoon
Pears, canned	3 halves and 3 tablespoons juice
Pears, fresh	2 medium-sized
Peas, fresh or canned, drained	¾ cup
Pineapple, fresh	2 slices 1 inch thick
Pineapple juice	⅔ cup
Potato salad	½ serving (1.7 ounces)
Potatoes, baked or boiled	1 medium-sized
Potatoes, mashed	½ cup (scant)
Potatoes, sweet	½ medium-sized
Prunes, stewed, sweetened	2 prunes and 3 tablespoons juice
Rice, steamed	¾ cup
Rice pudding	½ cup
Salmon, canned	½ cup
Sirloin steak, lean, broiled	slice 2 inches by 1½ inches by ¾ inch
Spinach, cooked	2½ cups
Sugar, granulated	2 level tablespoons (1 teaspoon = 20 calories)
Tapioca, cooked with apple	¼ cup
Tomato-and-lettuce salad	½ serving (2.7 ounces)
Tomatoes, canned	2 cups
Tomatoes, fresh	2 to 3 medium-sized
Turnips	2 cups (½-inch cubes)
Walnuts	8 to 16 nuts, according to size

HEALTH WORDS

You may use this list of words as you would a dictionary. It contains the words you will need to know the meaning of as you read this book. Following the explanation of each word you will find the number of the page on which it is first mentioned.

Abscess: collection of pus in some one part of the body; as, an abscess at the root of a tooth (p. 89)

Acid: a sour substance. Acid can eat through tooth enamel (p. 88)

Acid-forming germs: germs whose action on food or other substances results in acids (p. 88)

Activity: state of being active (p. 6)

Adenoid: the tonsil near the place where the nose opens into the throat. Because of its many divisions it is often called adenoids (p. 13)

Air sacs: tiny bags with very thin elastic walls which make up the lungs (p. 111)

Albumin: a kind of protein. The white of egg is almost pure albumin (p. 29)

Alcoholic beverage: a drink which contains alcohol, such as whisky, wine, or beer (p. 170)

Alcoholic fermentation: the changes brought about by yeasts in fruit juice or crushed grain sprouts with the result that alcohol and carbon dioxide are produced (p. 208)

Antibodies: substances manufactured by the body cells to work against disease germs or their toxins (p. 222)

Antidote: a substance that works against a poison (p. 221)

Antiseptic: a substance that destroys germs or makes them harmless (p. 211)

Antiseptic surgery: performing an operation in such a way as to keep the wound made by the surgeon from becoming infected (p. 213)

Apparatus: objects or machines used in carrying on a certain kind of play or work. A swing is the apparatus used in swinging (p. 243)

Arteries: the blood vessels that carry blood away from the heart (p. 103)

Attitude: a habit of mind which determines the way you act (p. 150)

Audiometer: a machine used to test the hearing (p. 158)

Bacteria: tiny plants consisting of only one cell. Some are harmless; others cause disease (p. 29)

Beriberi: a disease of the nervous system caused by not getting enough vitamin B (p. 152)

Beverage: a drink (p. 42)

Bicuspids: the eight teeth, four on the upper jaw and four on the lower jaw, which break and crush the food (p. 80; see also the diagram on page 85)

Blood stream: the blood flowing through the blood vessels (p. 52)

Blood test: the examination of a sample of blood to find out whether or not a person's blood is healthy (p. 107)

Blood vessels: the tubes through which blood flows to all parts of the body (p. 56)

Blubber: the layer of fat under the skin of a whale (p. 169)

Bran: the outer coating of grain (p. 156)

Bristles: short, stiff, coarse hair used in making toothbrushes (p. 93)

Calcium: a mineral in milk which unites with phosphorus to form bones and teeth (p. 30)

Calcium phosphate: the name that is given to the mixture of calcium and phosphorus of which the hard part of bones is made (p. 143)

Calorie: a unit for measuring heat; the amount of heat needed to make one pound of water four degrees hotter (p. 25)

Capillaries: tiny blood vessels with very thin walls which connect the arteries with the veins (p. 105)

Carbohydrates: fuel foods, the sugars and starches, which are burned in the body to make heat and energy (p. 26)

Carbolic acid: a liquid that acts as a powerful antiseptic (p. 211)

Carbon dioxide: a waste gas produced by the body cells which is carried by the red corpuscles to the lungs to be removed from the body (p. 108)

Cartilage: a firm, tough, elastic tissue of the body. Bones begin as rods or pieces of cartilage (p. 129)

Cell division: the dividing of one cell to make two cells (p. 15)

Cells: the tiny living bodies composed of protoplasm of which plants, animals, and human beings are made (p. 5)

Cementum: a bonelike material that forms the outside coating of the root of a tooth (p. 75)

Center of infection: a focal infection (p. 90)

Central nervous system: that part of the nervous system which is composed of the brain and the spinal cord (p. 149)

Charm: anything worn or any words spoken to bring good luck or to keep away bad luck (p. 230)

Chicken cholera: a communicable disease of chickens (p. 223)

Citrus fruits: a certain group of fruits, such as grapefruit, oranges, and lemons (p. 36)

Clot: the thick jellylike substance formed as a result of clotting (p. 107)

Clotting: the changing of a partly liquid substance, such as blood, into a jellylike substance (p. 106)

Cod-liver oil: an oil which is rich in vitamins A and D, pressed from the liver of the codfish (p. 22)

Communicable disease: a disease caused by germs which may be carried from one person to another (p. 202)

Constipation: the condition of not being able to have a daily bowel movement (p. 154)

Continuous: not coming to an end (p. 18)

Cowpox: a mild disease of cows caused by the germs of smallpox (p. 223)

Crown (of a tooth): the part of a tooth that shows above the gum (p. 75)

Crystal: clear and transparent, like ice or glass (p. 154)

Cuspids: the four teeth at the "corners" of the upper and lower jaws, used in holding food and tearing it apart (p. 80; see also the diagram on page 85)

Daydream: dreaming when one is not asleep of the things one would like to have or do (p. 184)

Defect: something wrong in the body; as a decayed place in a tooth (p. 98)

Dental clinic: a place where a person may have his teeth cared for by a dentist at small cost (p. 98)

Dental floss: a kind of waxed thread used in cleaning between the teeth (p. 94)

Dental hygienist: a dentist's helper who has been trained to clean and inspect the teeth (p. 94)

Dentifrice: a powder, paste, or liquid used in cleaning the teeth (p. 94)

Dentine: the white substance of which the body of a tooth is made (p. 75)

Diet: the foods eaten and the liquids drunk regularly (p. 28)

Digest: to change food in the digestive tract into the forms in which it can be used by the body cells (p. 12)

Digestion: the act of digesting (p. 51)

Digestive juice: a fluid of the body which contains materials which help to digest food (p. 52)

Digestive tract: the tube in which digestion takes place; it begins in the mouth and ends in the lower part of the large intestine (p. 52)
Disease ferments: germs that cause diseases (p. 209)
Disinfect: to free from infection; especially to destroy disease germs (p. 211)
Doze: to sleep lightly (p. 186)
Dried milk: milk from which all the water has been removed (p. 38)

Eardrum: the membrane stretched across the end of the passageway leading from the outer ear, which vibrates when sound waves strike it (p. 156)
Effect: that which is produced by one thing acting on another thing; as the effect of coffee on the heart (p. 43)
Enamel: a hard white substance that covers the crown of a tooth (p. 75)
Energy: the ability to do work (p. 9)
Erupt: to break through the surface; as, the teeth erupt (p. 77)
Eruption: the act of erupting (p. 100)
Esophagus: the tube leading from the throat to the stomach (p. 54)
Eustachian tube: the tube leading from the middle ear to the place where the nose opens into the throat (p. 158; see also the diagram on page 157)
Evaporated milk: canned milk from which part of the water has been removed (p. 38)
Experiment: a test made to get information about something or to find out whether an idea about something is true or false (p. 17)
Eye specialist: a person to whom people go to have their eyes examined or treated because he has made a special study of the eyes (p. 163)

Fahrenheit: the name given to the thermometer usually used in the United States and Canada. It was named after the scientist who invented it (p. 64)
Fatigue: the state of being tired (p. 180)
Fats: fuel foods, such as butter and fat, which are burned in the body to make heat and energy (p. 26)
Ferment (noun): anything which causes fermentation. Yeast and bacteria are ferments (p. 206)
Fermentation: the changes brought about by living ferments, such as yeast or bacteria, in anything that is alive or that was once a part of something alive (p. 203)
Fiber: tough, stringy material (p. 57)

First teeth: the set of twenty teeth which begin to erupt when a child is about six months old and which fall out when the permanent teeth under them are ready to erupt; the baby teeth (p. 75; see also the diagram on page 77)

Fish-liver oil: oil pressed from the livers of fish, such as the codfish and the halibut (p. 86)

Fluid: any substance which flows (p. 52)

Focal infection: an infection in some one part of the body (p. 90)

Focus: to bend rays of light so that they all fall on one spot (p. 161)

Framework: parts of anything fitted together to give it form or shape (p. 4)

Gas: a substance which is neither solid nor liquid, such as oxygen; air is a mixture of several different gases (p. 9)

Gastric juice: a digestive juice poured into the stomach, which begins the digestion of protein (p. 54)

Glands: organs of the body that make and pour out useful fluids (p. 52)

Habit: an act which you perform easily and quickly without thinking about it because you have done it so often (p. 150)

Handicap: that which stands in the way of success (p. 174)

Heart: the organ of the body that pumps blood through the blood vessels (p. 12)

Hitchhiker: a person who asks a strange motorist for a ride (p. 238)

Hobby: an occupation in which a person finds pleasure (p. 66)

Hydrochloric acid: a substance which dissolves the calcium and phosphorus in bone (p. 131)

Incisors: the four front teeth on the upper and lower jaws, used in cutting food (p. 80; see also the diagram on page 85)

Indigestion: a condition caused by not being able to digest food properly (p. 41)

Inner ear: the space beyond the middle ear from which sound messages are sent to the brain over the nerve of hearing (p. 158; see also the diagram on page 157)

Interpret: to explain the meaning of something (p. 162)

Intersection: a place where two or more streets meet (p. 237)

Invisibility. The state of not being able to be seen (p. 230)

Involuntary muscles: muscles in the walls of various organs of the body which are not under the control of the will (p. 133)

Iodine: a mineral, found especially in oysters, clams, fish caught in the sea, and other sea foods, which is needed by the body (p. 30)
Iris: the part of the eye which makes the pupil larger or smaller and which is colored differently in different persons (p. 161)
Iron: a mineral which is used in building red blood corpuscles and which is also present in all body cells (p. 30)
Irritate: to make red and sore (p. 41)

Jaywalker: a person on foot who crosses a street between intersections (p. 237)

Kidneys: the two small organs which help to remove liquid wastes from the body (p. 29)

Laboratory: a place where scientists work to gain new knowledge (p. 22)
Large intestine: the tube at the lower end of the digestive tract where undigested food is held until it is removed from the body (p. 52)
Leisure: time free from work that is required; spare time (p. 12)
Lens: the part of the eye back of the pupil which focuses light rays on the retina (p. 161)
Liver: a large organ located above and to the right of the stomach, which stores sugar and does other important work in the body (p. 57)
Lungs: two organs of the body, located in the chest, in which oxygen is delivered to the red corpuscles of the blood and carbon dioxide is unloaded from them (p. 9)
Lymph: the watery liquid which has soaked through the walls of the capillaries into the spaces between the body cells (p. 52)

Malaria: a communicable disease caused by germs which are carried from one person to another by a certain kind of mosquito (p. 189)
Marathon: a race over a distance of twenty-six miles and eighty-five yards, named after a famous event which took place long ago in Greece (p. 115)
Mature: grown up; ripe (p. 16)
Membrane: a very thin tissue of the body (p. 70)
Microscope: an instrument which makes it possible to see things too small to be seen by the eyes alone (p. 20)
Middle ear: the space across which three tiny bones carry sound messages from the eardrum to the inner ear (p. 156; see also the diagram on page 157)

Minerals: materials which are usually solid, such as iron, gold, calcium, table salt, rocks, and the like; minerals are present in many foods which are used in the body for many important activities (p. 30)

Molars: the twelve back teeth, three on each side of the upper and lower jaws, which grind food (p. 81; see also the diagram on page 85)

Neck (of a tooth): the place at the gum line where the root and crown of a tooth meet (p. 75)

Nerve cells: the cells of which the nervous system is composed (p. 147)

Nerves: the cordlike tissues which connect the brain and spinal cord with all other parts of the body (p. 75)

Nervous system: the system composed of the brain, spinal cord, and nerves, which controls everything that goes on in the body (p. 146)

Nicotine: the principal harmful drug in tobacco (p. 119)

Night blindness: a condition of the eyes which makes it impossible for a person to see in a dim light (p. 164)

Nitrogen: a certain material that will not burn and which is present in protein, in all body cells, and also in air in the form of a gas (p. 29)

Outer ear: the part of the ear you see and the passageway leading from it to the eardrum (p. 156)

Oxygen: a gas present in the air which the body cells must have in order to stay alive (p. 9)

Papillae (*singular*, papilla): the little knobs on the tongue in which the sense organs of taste are located (p. 167)

Pasteurization: the heating of a liquid, such as milk, to a temperature high enough to kill any harmful ferments, or germs, that may be in it (p. 203)

Pasteurized milk: bottled milk which has been heated to destroy any harmful bacteria which it may have contained (p. 38)

Pedestrian: a person on foot; a walker (p. 234)

Permanent teeth: the set of thirty-two permanent teeth which begin to erupt at about the age of six years and which are supposed to last for life (p. 75; see also the diagrams on pages 81 and 85)

Phosphorus: a mineral present in many foods, which unites with calcium to form bones and teeth (p. 30)

Physical examination: an examination of the body made by a doctor to find out whether or not a person is in good health. It is often called a health examination (p. 13)

Pinkeye: a communicable disease of the eyelids (p. 163)

Portion: a helping of food (p. 137)

Precaution: something done beforehand to protect oneself or others from danger; as, to take precautions against accidents (p. 250)

Protective foods: foods which contain vitamins (p. 32)

Protein: a material containing nitrogen which is present in foods, such as milk, eggs, and meat, and which is used by the body cells for building and repair (p. 29)

Protoplasm: the jellylike living material of which cells are composed (p. 5)

Pulp (of a tooth): soft material in the center of a tooth, composed of blood vessels and nerves (p. 76)

Pulp chamber: the hollow space in the center of a tooth (p. 76)

Pulse: the beat of the heart felt as the beat of a wave of blood against the wall of an artery close to the surface of the body (p. 112)

Pupil: the small round opening through which light enters the eye (p. 161)

Pus: a thick yellowish substance composed of dead white corpuscles and dead germs, which is a sign of infection (p. 89)

Quarantine: a person is said to be quarantined when all visitors are kept away from him because he has a communicable disease (p. 214)

Red corpuscles: the red cells in the blood that carry oxygen to the body cells and take away carbon dioxide from them (p. 108)

Relax: to allow the muscles to become soft and limp instead of hard and tight (p. 178)

Relaxation: the state of being relaxed (p. 194)

Retina: the film at the back of the eye on which light rays reflected from an object make a picture of the object (p. 161)

Rickets: a disease in which the bones become soft and easily bent out of shape (p. 131)

Root canal: a little tunnel running down through the root of a tooth from the pulp chamber (p. 76)

Roughage: coarse material in food, which is not digested and which helps the bowels to move (p. 58)

Sac: a small part of the body formed like a bag; the little bag in the jawbone in which a tooth grows (p. 76)

Saliva: a digestive juice poured out into the mouth, which changes starch to sugar (p. 52)

Salivary glands: three pairs of glands in the lining of the mouth, which make and pour out saliva (p. 52)

School safety council: the members of a school who are organized to work for safety in the school building and on the school playground (p. 240)

Schoolboy Patrol: a group of older boys in a school who stand on the sidewalk near the curb and keep children from crossing a street until it is safe to do so (p. 237)

Scientist: a person who studies any part of the world about him and tries to find out why things happen as they do (p. 9)

Scurvy: a disease caused when there is no vitamin C in the diet (p. 31)

Self-reliance: depending on oneself to do things (p. 150)

Sense organ: a nerve cell or group of nerve cells that receives information about what you see, hear, taste, touch, or smell, and sends it over a nerve to the central nervous system (p. 149)

Sixth-year molars: the first permanent teeth to erupt. This happens usually at the age of six years (p. 82; see also the diagrams on pages 81 and 85)

Skeleton: all the bones of the body joined together to make the framework of the body (p. 126)

Skull: the round box of bones in which the brain is enclosed (p. 126)

Small intestine: a long narrow coiled tube opening out of the lower part of the stomach, where completely digested food passes into the blood (p. 55)

Socket: the hollow in the jawbone out of which a tooth grows (p. 84)

Sodium chloride: the mineral that the liquid part of the blood contains in the largest amount; table salt (p. 110)

Solution: a mixture formed by dissolving a substance in water or some other liquid (p. 211)

Spinal cord: the rope of nerve tissue which runs up through the backbone to the brain (p. 149)

Spine: the column of small bones which runs up the middle of the back to the skull; the backbone (p. 126)

Sportsmanship: conduct becoming to a sportsman, that is, a person who is fair and generous, especially in games and sports, and who is a good loser and a gracious winner (p. 250)

Sterile: free of germs (p. 213)

Sterile gauze: a kind of cloth that has been made free of germs (p. 213)

Stethoscope: an instrument for listening to sounds made by the heart and lungs (p. 115)

Steward: a person who looks after things for another person (p. 153)

Stomach: an elastic bag in the body in which food is held while it is being mixed with gastric juice (p. 41)

Substance: the material of which anything is made (p. 5)

Surgeon: a doctor who performs operations (p. 211)

Surgery: the work done by surgeons (p. 211)

Tartar: a hard substance which collects at the necks of the teeth (p. 94)

Tissue: any part of the body made of many similar cells, such as muscle tissue or nerve tissue (p. 6)

Tonsils: small masses of tissue in the throat which sometimes become enlarged or diseased and have to be removed (p. 13)

Toxin: poison of plant or animal origin (p. 222)

Toxin-antitoxin: a very small amount of diphtheria toxin mixed with diphtheria antitoxin to make it harmless, which is used in protecting a person from diphtheria (p. 224)

Toxoid: a very small amount of the toxin of diphtheria mixed with something to make it harmless, which is used to protect a person from diphtheria (p. 224)

Typhoid fever: a communicable disease which is most often spread by impure water or impure food, especially milk (p. 202)

Ultraviolet rays: short rays of the sunlight which make it possible for the body to manufacture vitamin D when they fall on the bare skin (p. 86)

Vaccination: protecting a person from smallpox by putting weak smallpox germs into his body. Protecting a person from some other communicable disease, such as typhoid fever, may also be called vaccination (p. 203)

Valve: a small flap of tissue in a tube or hollow organ of the body which keeps things moving in the right direction by opening and shutting, like a door, at the proper times (p. 55)

Veins: the blood vessels that carry blood toward the heart (p. 111)

Ventilation: supplying a room with fresh moving air (p. 203)

Vibrate: to move rapidly back and forth (p. 156)

Villi: tiny hairlike tissues reaching out from the lining of the small intestine, which soak up digested food (p. 56)

Visual purple: a substance in the eye which helps a person to see in dim light (p. 165)

Vitamin A: a vitamin which helps to protect the body against infection and certain eye diseases (p. 32; see the table on page 49 for its chief sources)

Vitamin B: a vitamin especially needed to keep the nervous system healthy (p. 32; see the table on page 49 for its chief sources)

Vitamin C: a vitamin which protects against scurvy (p. 32; see the table on page 49 for its chief sources)

Vitamin D: a vitamin which is necessary for building bones and teeth (p. 32; see the table on page 49 for its chief sources)

Vitamin-D milk: milk in which the amount of vitamin D it ordinarily contains has been increased (p. 87)

Vitamin G: a vitamin necessary for growth (p. 32; see the table on page 49 for its chief sources)

Vitamins: materials present in many foods in very small amounts which are necessary for growth and health (p. 25)

Voluntary muscles: muscles attached to bones, which move at the command of the will (p. 132)

"Wandering" cells: the white corpuscles (p. 108)

Well-balanced meal: a meal that contains in the right amounts all the different food substances the body needs (p. 61)

White corpuscles: the white cells of the blood that destroy germs by devouring them; "wandering" cells (p. 89)

Wisdom teeth: the last four molars to erupt (p. 84; see also the diagram on page 85)

X-ray picture: a picture taken with the help of X rays (p. 90)

X rays: rays, similar to light rays, which go through substances that ordinary light cannot pass through (p. 90)

Yeast: a plant consisting of only one cell, that acts as a ferment (p. 204)

INDEX

Key to the Sounds

ă *as in* at	ē *as in* be	ō *as in* note
ā *as in* ate	ē *as in* her	ô *as in* horse
ä *as in* father	ĭ *as in* bit	o͝o *as in* foot
â *as in* care	ī *as in* bite	ŭ *as in* us
ĕ *as in* bet	ŏ *as in* not	ū *as in* use

zh *like the* s *in* pleasure

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